HANDBOOK of OPERATION

and

MAINTENANCE INSTRUCTIONS

for

IP-206/URR
PANORAMIC INDICATOR

PANORAMIC RADIO PRODUCTS, INC.
MOUNT VERNON, NEW YORK

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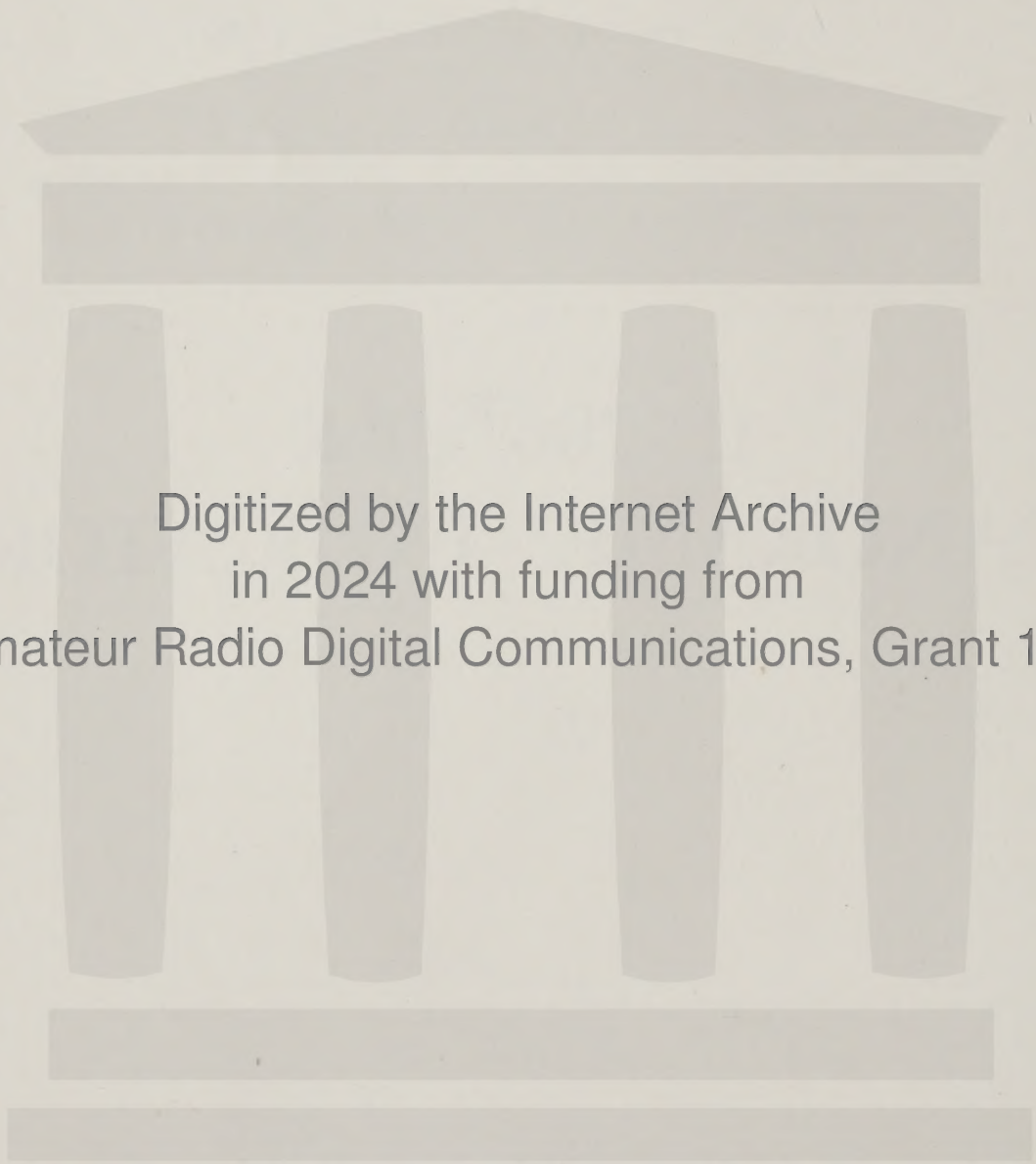

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ILLUSTRATIONS

SAFETY NOTICE

The attention of officers and operating personnel is directed to Chapter 67 of the BUREAU OF SHIPS MANUAL or superseding instructions on the subject of radio-safety precautions to be observed.

This equipment employs voltage which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised when working with the equipment.

While every practicable safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS:

Operating personnel must at all time observe all safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Under certain conditions dangerous potentials may exist in circuits with power controls in the off position due to charges retained by capacitors. To avoid casualties always remove power and discharge and ground circuits prior to touching them.

DON'T SERVICE OR ADJUST ALONE:

Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS:

Do not depend upon door switches or interlocks for protection but always shut down motor generators or other power equipment. Under no circumstances should any access gate, door, or safety interlock switch be removed, short-circuited, or tampered with in any way, by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

RESUSCITATION

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR, OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

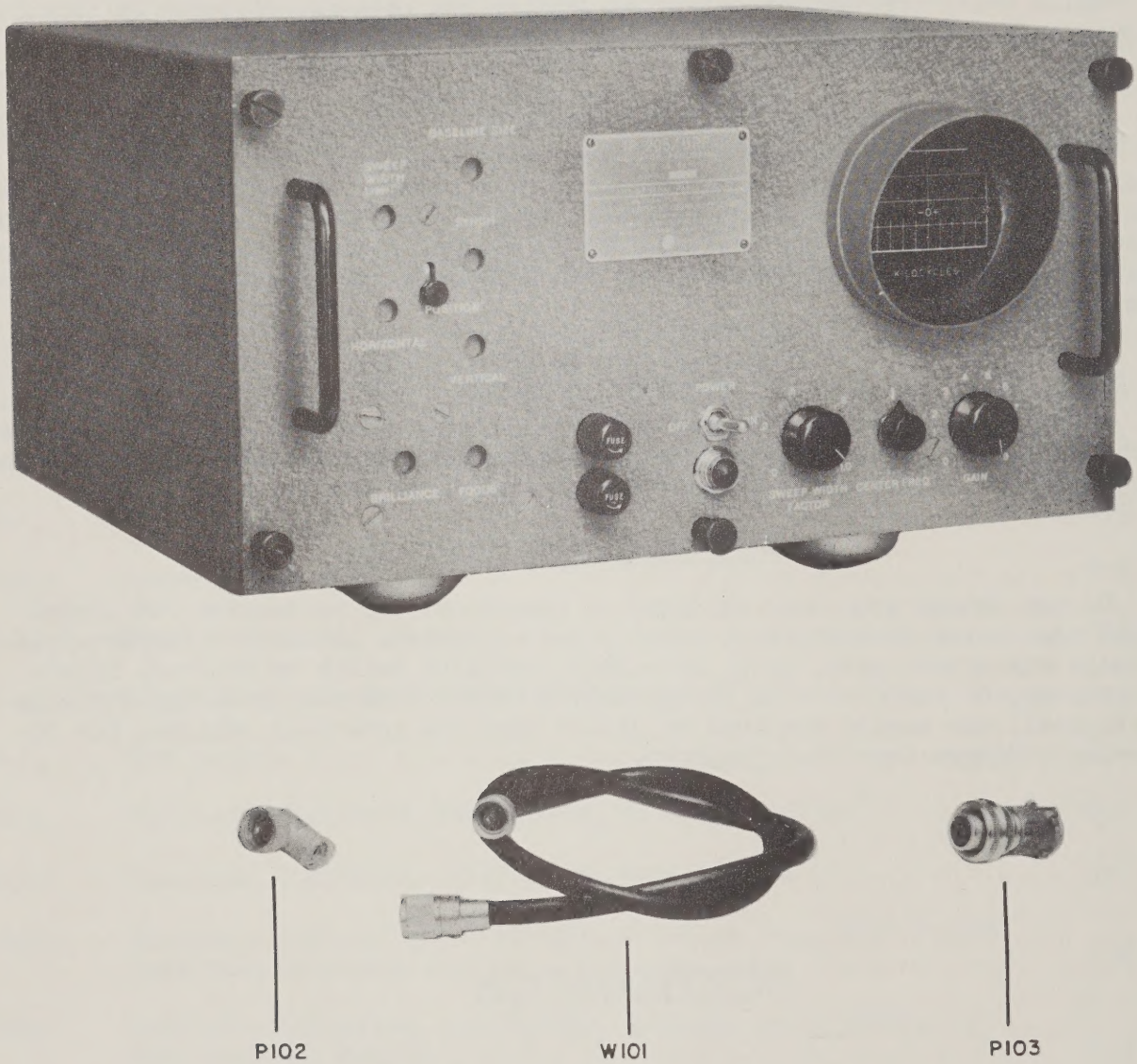


Figure 1-1. Panoramic Indicator IP-206/URR, Complete Equipment

SECTION I

GENERAL DESCRIPTION

1-1. INTRODUCTION.

1-2. This Handbook is intended for use with the IP-206/URR Panoramic Indicator. The purpose of the Handbook is to familiarize the operator thoroughly with the application and operation of the instrument. Included within this Handbook is detailed information on maintenance of the equipment. The equipment operates on 115V, 50-70 cycles, single phase. It consumes approximately 60 watts. Refer to schematic Fig. 7-3 for changes necessary for 230 volt operation.

1-3. EQUIPMENT TABLES.

TABLE 1-1

EQUIPMENT SUPPLIED

1- Panoramic Indicator.
1- R.F. Cable, 3 feet in length terminated with a Navy Type 49195 plug at each end. Cable Type RG-8/U, AN Cord CG-107/U (3'0").
1- Angle Plug Adapter Navy No. 49192.
1- Power Plug A.C. AN3106-14S-7S and AN 3057-6 cable clamp.

1-4. GENERAL.

1-5. The Panoramic Indicator is essentially an automatic scanning superheterodyne receiver which permits continuous visual observation of RF signals present within a band up to 100KC wide.

1-6. Through the use of a cathode-ray tube indicator at the output of the instrument, the frequency spectrum is visualized on a two-dimensional surface. Signals are displayed as inverted V-like pips distributed in order of frequency along the horizontal axis of the cathode-ray tube screen. The height of each pip is a direct indication of the relative magnitude of its corresponding signal. The illustration below shows a typical presentation of a number of signals on the screen.

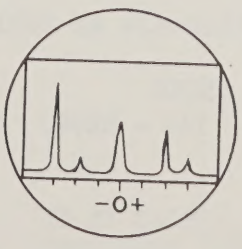


Figure 1-2. Typical indication of a number of signals, indicator adjusted for reduced scanning width. Pips would be very much narrower for fuller scanning width.

1-7. The screen is calibrated horizontally in terms of frequency. It is marked 0 (zero) in the center, +50 on the right and -50 on the left. On each side of zero the scale is divided into five parts, each vertical division mark corresponding to a 10KC frequency separation when the indicator scans a maximum bandwidth of 100KC.

1-8. By examining the panoramic screen, it is comparatively simple to determine the relative frequencies and magnitudes of various displayed signals.

1-9. Furthermore, the characteristics of signals may be revealed by the behavior or.composition of the display. Interpretation of screen presentations are contained in Section II - Operating Procedures.

1-10. Detailed analysis of spectrum segments less than 100KC wide can be accomplished through magnification of the portion in question. To do this the receiver is adjusted so that the segment is centered on the screen. The spectrum portion is then spread across the entire screen by reducing the scanning width by means of a continuously variable control (SWEEP WIDTH FACTOR) on the front panel.

1-11. TUBE COMPLEMENT.

Circuit Designation	Tube Type	Function
V101	JAN-12AT7	R.F. Amplifier
V102	JAN-6AU6	Bandpass Amplifier
V103	6BA7	Frequency Mixer
V104	JAN-6AU6	I.F. Amplifier
V105	JAN-6AV6	Detector, Video Amplifier
V106	JAN-0B2	Voltage Regulator
V107	JAN-6C4W	Local Oscillator
V108	JAN-6AU6	Reactance Modulator
V109	JAN-12AT7	Sweep Amplifier, Video Amplifier
V110	JAN-3RP1	Cathode-ray Tube Indicator
V111	JAN-6X4W	Low Voltage Rectifier
V112	JAN-2X2A	High Voltage Rectifier
V113	JAN-12AT7	Sawtooth Sweep Generator, Sweep Amplifier

1-12. ELECTRICAL CHARACTERISTICS.

1-13. The electrical characteristics are as follows:

Maximum Sweepwidth	:	±50KC
Center Frequency	:	390 - 410KC
Low Frequency Alignment (plus side of screen)	:	350KC ±5 KC
High Frequency Alignment (minus side of screen)	:	450KC ±5KC

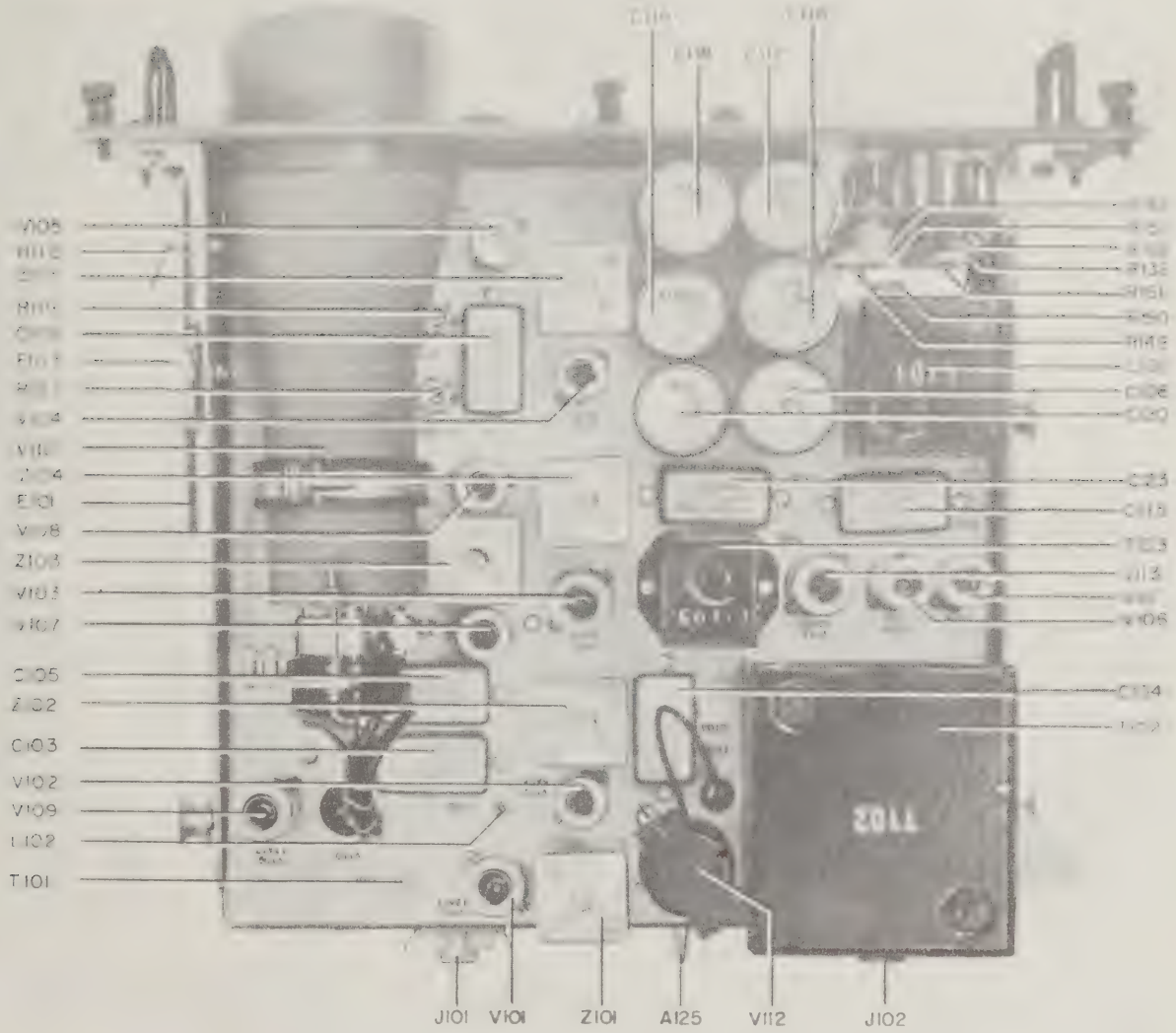


Figure 1-3. Panoramic Indicator IP-206/URR, Top View of Chassis

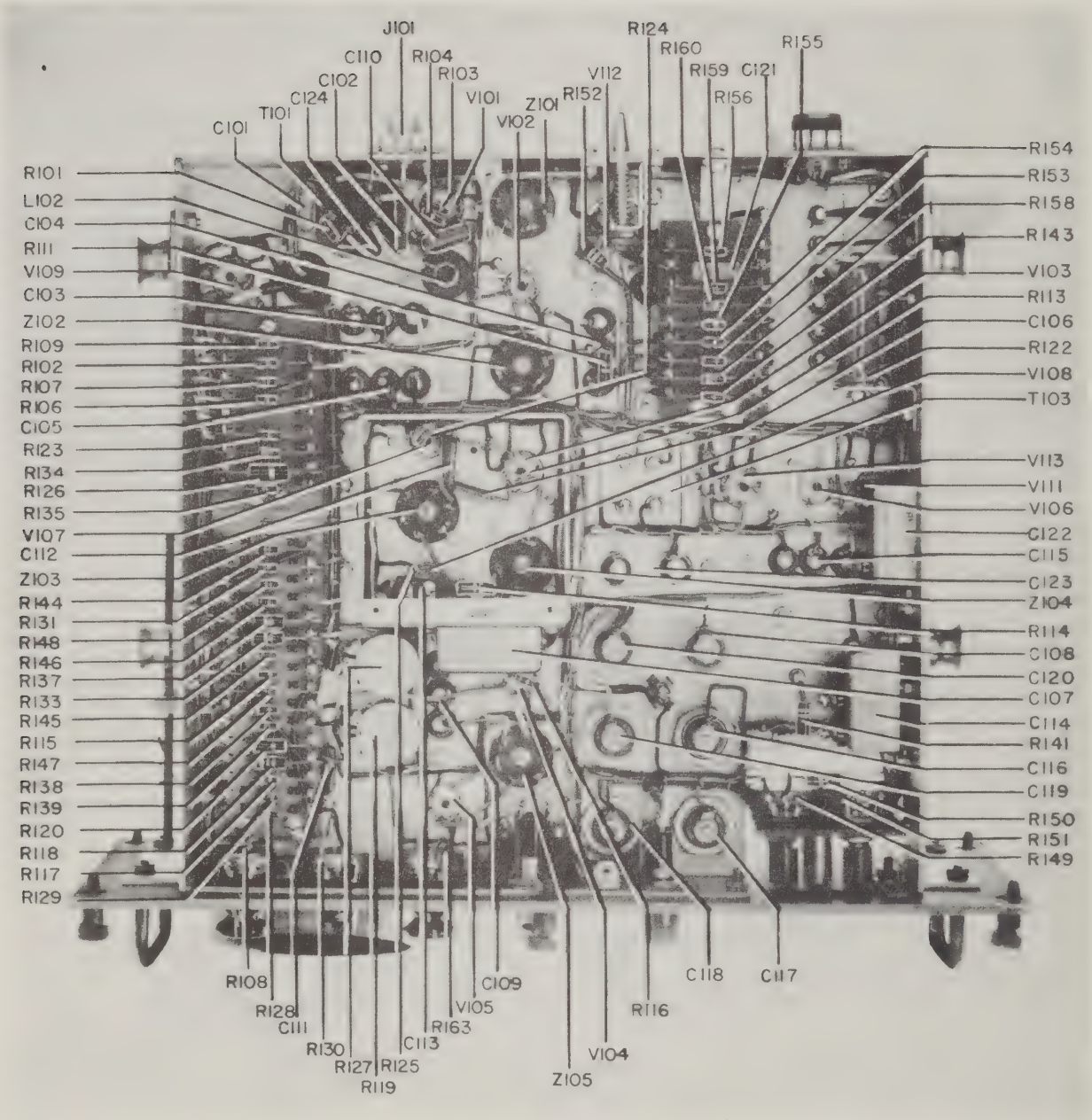


Figure 1-4. Panoramic Indicator IP-206/URR, Bottom View of Chassis

Bandpass Region	: 350KC to 450KC
Bandpass Response	: Peak to valley ratio greater than 8:1
Image Rejection Ratio	: Better than 10:1 at 400KC
Direct Sensitivity	: 10 microvolts for 5/8" deflection
Input Impedance	: 50 ohms
Effective Resolution at maximum Sweepwidth	: 5KC maximum
Intermediate Frequency	: 226KC
FM Oscillator Mean Freq.	: 626KC
Oscillator Excursion	: 576 - 676KC
Sweep Frequency	: 30 cps (half line frequency)
Power Source Required	: 115 V., 50 - 70 cycles, 1 ϕ
Power Consumption	: 60 watts (approximate)
Fuses	: 3AG/2A(2 ampere)

1-14. DIMENSIONS.

1-15. Dimensions are as follows:

Panel Size--Width 16", Height 8 1/4".
Overall Dimensions--Width 16", Height 9 1/4", Depth 13"
Weight of chassis with tubes -- 28-1/2 lbs.
Weight of complete equipment -- 40 lbs.

1-16. TERMS AND DEFINITIONS

1-17. Sweepwidth is the band, measured in cycles, kilocycles or megacycles, which can be observed by Panoramic Reception and which corresponds to the range of oscillator sweep in the Panoramic equipment.

1-18. Frequency Sweep Axis is the line along which the signal deflections are produced and which can be calibrated in frequency according to a given frequency scale.

1-19. Center Frequency is the frequency of the signal received on that part of the frequency sweep axis corresponding to zero sweep voltage applied to the reactance modulator. See Theory of Operation.

1-20. Resolution of a given signal is the frequency difference measured along the frequency scale between the points where its deflection is 30% down from the peak value. This characteristic corresponds to "selectivity" in ordinary receivers. The smaller this frequency difference, the better the resolution is.

1-21. Sweep Frequency is the number of times per second the electron beam sweeps across the cathode-ray tube.

1-22. Deflection Amplitude is the visual equivalent of signal deflection measured from the baseline to the top of the deflection.

1-23. Screen Scale is the scale adjacent to the base line which is calibrated in frequency units above and below center frequency for a maximum sweepwidth setting.

1-24. Companion receiver is the associated unit which is connected to the indicator. The receiver must have an I.F. of 390 to 410KC.

SECTION II

OPERATING PROCEDURES

2-1. GENERAL.

2-2. The Panoramic Indicator is essentially an automatic scanning superheterodyne receiver. It allows visual observation of the frequency, amplitude and character of RF signals present within a band up to 100KC wide.

2-3. All controls required for operation of the equipment are located on the front panel.

2-4. The panel controls and indicators and their functions are as follows:

2-5. SWEEP WIDTH FACTOR. This is the scanning width control. When it is turned completely to the right (clockwise) the maximum bandwidth for which the instrument is designed can be seen on the screen. As the control is backed off counterclockwise, the bandwidth viewed becomes narrower, but the part that can be seen is expanded across the entire screen and hence is virtually magnified.

2-6. The control is particularly useful for separating two or more signal deflections which are so close as to almost merge into each other. It is, in effect, a "variable visual selectivity" control.

2-7. The calibrations below maximum are only approximations and should be considered as such.

2-8. CENTER FREQ. This control serves to restore and maintain the scanning FM oscillator at its specified mean frequency so that the deflection for an input center frequency of 400KC appears at the center of the screen. The control seldom requires adjustment but when the centered condition does not exist, correction is easily obtained.

2-9. GAIN. The amplitude of the deflections is governed by this control. It is best to use low gain wherever possible to reduce the size of both spurious and noise deflections which may appear.

2-10. POWER. This switch located in the center of the panel turns all power to the equipment on or off.

2-11. PILOT LIGHT. Located underneath the power switch, this indicator goes on and off with the switch.

2-12. CATHODE-RAY INDICATOR. Signal presentations are displayed on the face of its screen. The viewing end of the tube is protected by a green plastic screen shield which is engraved with frequency and amplitude scales.

2-13. OPERATING PROCEDURE.

a. Turn on the power and wait for the baseline to appear.

b. Allow the indicator to warm up for approximately 15 minutes.

c. Set the SWEEP WIDTH FACTOR control fully clockwise.

d. Set the GAIN control at maximum, fully clockwise.

e. Set CENTER FREQ. on or near the vertical marker as indicated in SECTION III - OPERATING CHECKS AND ADJUSTMENTS, paragraph 3-7.

f. Adjust the companion receiver which is connected to the input R.F. connector of the panoramic indicator so that a signal is heard on the headphones or speaker.

g. The signal should appear at the center of the screen.

h. To locate the signal at the center of the screen it may be found convenient to operate CENTER FREQ. control and set the panoramic indicator for high gain. Once the signal is located, the GAIN control may be backed off counterclockwise and the CENTER FREQ. control adjusted to obtain a signal deflection which is in the center of the screen.

2-14. NARROW BAND ANALYSIS.

2-15. When signals are so closely spaced in frequency that at full sweepwidth their corresponding deflections merge into one another, it may be possible to separate or resolve them.

2-16. The following procedure is used:

a. Adjust the frequency of the receiver so that the signals to be resolved appear at the center (0) of the screen.

b. Gradually reduce the scanning width by turning the SWEEP WIDTH FACTOR control counterclockwise. This may cause the signals in question to shift off the screen. In this case, trim CENTER FREQUENCY control to maintain the centered condition.

NOTE

The equipment can be turned off in an emergency by turning the POWER switch to OFF.

2-17. INTERPRETATION OF SIGNALS.

2-18. With a little experience, the operator will be able to recognize visually the character of the various types of signals.

2-19. A constant carrier appears as a deflection of fixed height. Refer to figure 2-2 details a, and b.

2-20. An amplitude modulated carrier appears as a deflection of variable height. Non-constant modulation causes the carrier to vary irregularly. A constant tone modulation of low frequency will produce a series of convolutions varying in height, their number being determined by the modulation frequency.

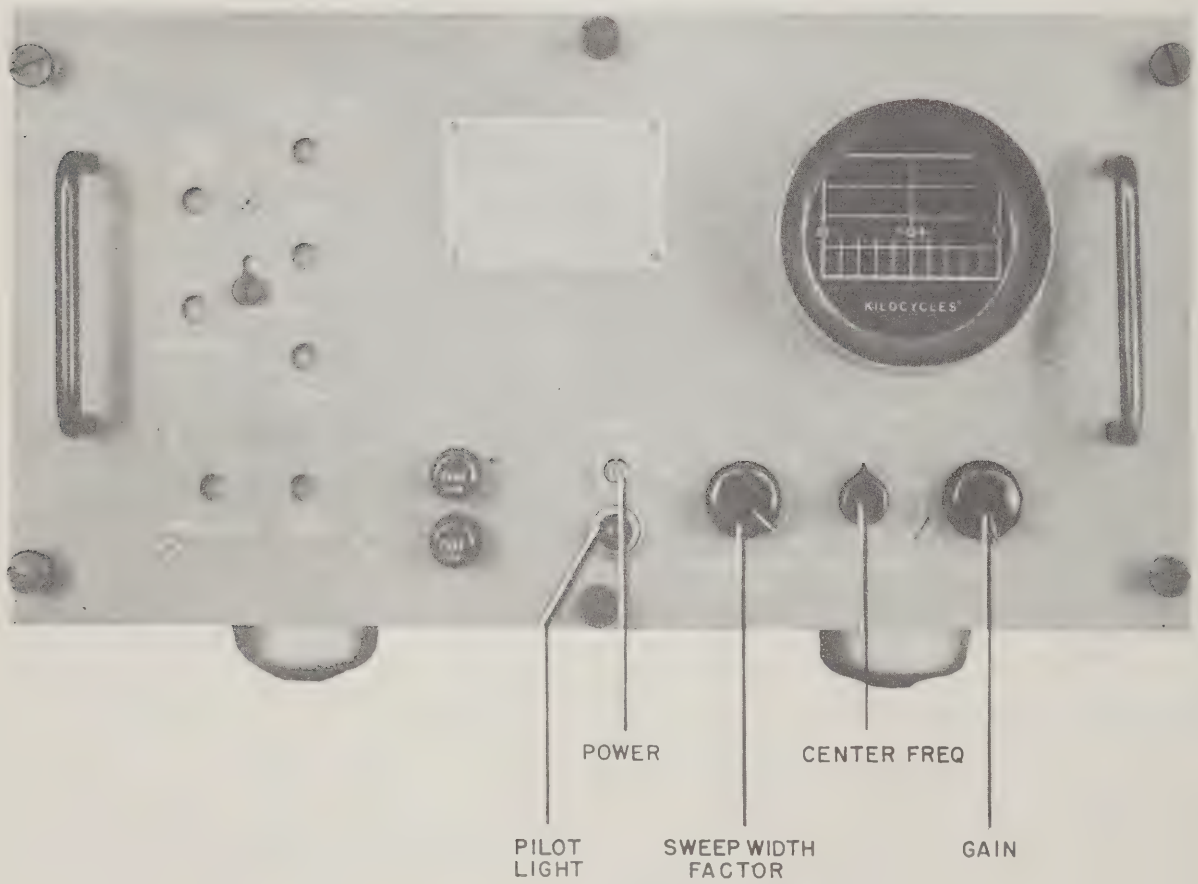


Figure 2-1. Panoramic Indicator IP-206/URR, Operating Controls

The nature of the presentation will depend upon the scanning width.

2-21. As the modulation frequency increases the convolutions move toward the two sides of the deflection, and the side bands tend to become visible. When the modulation frequency is increased, it becomes possible to separate the side-bands by reducing the sweepwdith of the indicator. The higher the frequency of modulation, the farther away these sidebands will move from the center deflection, representing the carrier. Refer to figure 2-2 details c, and d.

2-22. Single side-band modulation appears as two carriers of slightly different frequency when the modulating frequency is greater than the resolution (see "Signal Interference").

2-23. An FM Signal, in which the extent of modulation changes, appears as many deflections spreading over a variable bandwidth. During periods of "silence" a single carrier deflection shows. The extent of deviation can be determined directly by observing the panoramic screen.

2-24. From sine wave modulation at a frequency above the resolution of the indicator, the individual side currents show on both sides of the carrier. Non-symmetrical modulation may be observed as a shift in frequency of the carrier and side currents. The fall and rise of the carrier and side currents may be seen as the deviation is increased.

2-25. For modulating frequencies much below the resolution of the indicator, individual side currents may not be seen but the signal energy distribution of the signal through the frequency spectrum is shown by the envelope of the deflections. See figure 2-2 detail e.

2-26. A CW Signal appears and disappears in step with the keying of the transmitter. During the moments when the signal is off, the frequency sweep axis is closed at the base of the signal. In very rapidly keyed signals the deflection and the baseline are seen simultaneously.

2-27. An MCW signal appears like a CW signal of periodically varying height. If the modulation rate is high, sidebands will appear as explained above.

2-28. **Signal Interference,** two signals which are so close in frequency as to cause aural interference (beats), may appear on the screen as a single deflection, varying in height as with a modulated signal. As the frequency separation is increased, the deflection appears as if modulated on one side only. Further increase of frequency will cause a "break" in the apex of the deflection. By reducing the sweepwidth of the indicator the respective deflection will gradually separate. See figure 2-2 details g and h.

2-29. Transient disturbances, general examined, are of two types: periodic and aperiodic transients.

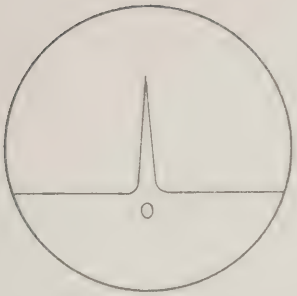
2-30. Periodic transients, such as produced by motors, vibrators, buzzers, etc., appear as signals moving along the frequency sweep base line in one direction or another. Thus an engine which is accelerating will produce a set of deflections which may move first in one direction, slow down, stop, and then move in an opposite direction. This is caused by the fact that the indicator is sweeping at a fixed rate, whereas the transient occur at a variable rate. The images stand still on the screen when there is synchronism between the two. If the transient disturbance is synchronized with the 60 cycle line the "noise" appears as a fixed signal which, however, does not move on the screen when the receiver is tuned, but only varies in height. Such deflections may appear like amplitude modulated signals or like steady carriers (see below "Diathermy apparatus"). Aperiodic transients, such as "static" appear as irregular deflections and flashes along the whole frequency sweep axis.

2-31. Diathermy or other apparatus using an unfiltered or AC power supply will produce a periodic disturbance which cause a deflection to appear on certain portions of the screen and disappear on other portions. This is due to the fact that such equipment emits a signal pulsating in synchronism with the power line. On the other hand, the indicator too, is sweeping the spectrum in synchronism with the line, but at a lower frequency and only when a certain phase relationship exists is it possible for the indicator to receive these periodic pulses.

2-32. **Spurious Signals,** if the signal strength exceeds a certain value, the deflection caused by any signal breaks up into a series of parallel deflections, somewhat similar to side-bands. To remedy this, reduce the Gain of the Panoramic Indicator or the R.F. Gain of the companion receiver.

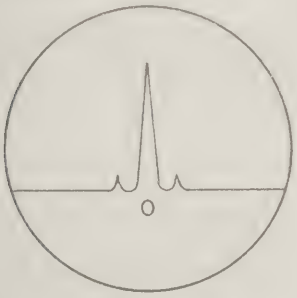
2-33. Images, if the receiver allows "images" to pass (due to poor image rejection of the R.F. circuits) these will be distinguishable from normal signals by the fact that they move in an opposite direction with respect to normal signals on the screen of the panoramic indicator when the companion receiver is being tuned. Such images are most likely to appear on the higher frequency ranges of the receiver.

2-34. A Pulsed R.F. Signal may appear as a series of sharp pips of various heights producing a pattern which shows where the energy of the signal is distributed. If the pulse modulation rate is in synchronism with the sweep rate of the Panoramic Indicator, the pips will remain at fixed positions. When there is a lack of synchronism, the pips will seem to move across the screen. At the same time they rise and fall in height and in so doing describe the pattern mentioned above. Refer to figure 2-2 detail f.

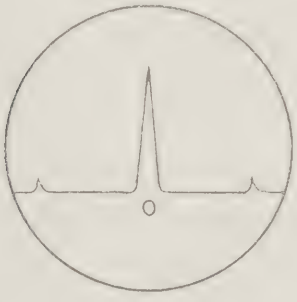


A. CONSTANT CARRIER SIGNAL. SWEEPWIDTH FACTOR CONTROL ADJUSTED FOR APPROXIMATELY MAXIMUM SWEEPWIDTH.

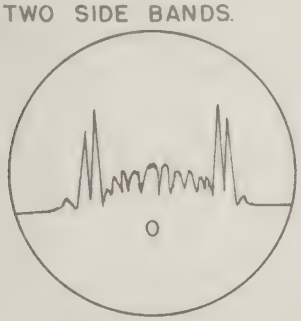
B. APPEARANCE OF CONSTANT CARRIER AT REDUCED SWEEP-WIDTH.



C. ILLUSTRATION OF AN AMPLI-TUDE MODULATED SIGNAL SHOW-ING CARRIER AT "0" ON SCREEN AND TWO SIDE BANDS.

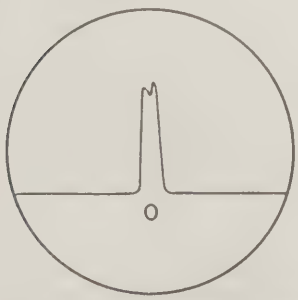


D. SAME AM SIGNAL AS IN C EXCEPT SWEEPWIDTH IS REDUCED. CARRIER REMAINS AT CENTER OF SCREEN.



E. FREQUENCY DISTRIBUTION OF AN FM SIGNAL.

F. SPIKES INDICATING DISTRI-BUTION OF A PULSED RF SIGNAL.



G. TWO INTERFERING CARRIERS DEPICTED AT MAXIMUM SCANNING WIDTH.

H. SAME SIGNALS AS IN "G"; SWEEPWIDTH REDUCED RESULTING IN IMPROVED SEPARATION OF RESOLUTION. OF SIGNALS.

Figure 2-2. Appearance of Typical Panoramic Indications

SECTION III

INSTALLATION, OPERATING CHECKS, AND ADJUSTMENTS

3-1. PRELIMINARY CHECK PROCEDURE.

3-2. The Panoramic Indicator is wired for operation from a 115 V, 50-70 cycle, single phase power source. See diagram Fig. 7-3 for 230 V operation.

3-3. The Panoramic Indicator may be installed as follows:

a. The Panoramic Indicator may be mounted over the companion receiver or it may be set in a rack. However, if possible, do not mount the indicator over ventilation holes of the companion receiver. See Fig. 3-1 for installation data.

b. The Panoramic Indicator is connected to the power supply by inserting the female plug of the power cable into the power receptacle on the back of the chassis. The plug is polarized. The male plug on the power cable is inserted into the power source. The type MCOS-2 cable will be furnished by the Navy as an installation matter.

c. Make sure that the companion receiver I.F. is 390 ± 10KC. An R.F. cable, supplied with the equipment, should be connected to the receptacle at the rear of the Panoramic Indicator and the other end of the cable to the Pan. output receptacle of the companion receiver.

3-4. Prior to operation, the CENTER FREQ. control and several of the semi-adjustable controls located behind access holes on the front panels should be checked for proper adjustment.

3-5. Normally, the semi-adjustable controls will not require attention. A quick visual inspection of the screen indications, however, will reveal whether or not adjustment is necessary. The semi-adjustable controls are potentiometers which have slotted shafts. They may be rotated by means of a screwdriver inserted through the front panel hole corresponding to each of the controls.

3-6. Check the baseline trace first by using the following procedure:

a. Snap the front panel POWER switch to ON. The pilot light should go on at once. In about one-half minute the baseline trace should appear on the screen.

b. Check the brightness of the trace. The brilliance should be sufficient for good visibility but the trace should not be made to compete with sunlight or artificial strong light. If required, adjust the BRILLIANCE control to get the desired brightness.

c. Check the sharpness of the trace. If the trace is thick or blurry, adjust the FOCUS control to get the sharpest indications.

d. Check the baseline trace for coincidence with the lower-most horizontal line on the screen. If there is a lack of coincidence, adjust the VERTICAL POSITION control.

e. Check the length of the horizontal trace. It should be slightly longer than the engraved baseline on the screen. Adjustment, if required, is effected with the BASELINE SIZE control. Clockwise rotation of the control increases the length of the baseline trace.

3-7. Check the adjustments of the HORIZONTAL POSITION and CENTER FREQ. controls in the following manner.

a. Allow both the Panoramic Indicator and the companion receiver with an I.F. of 390-410 KC to "warm up" to their respective operating temperature.

b. Set the SWEEP WIDTH FACTOR control to maximum. Feed the I.F. voltage from the companion receiver to the RF input connector of the indicator. Disconnect any other source of RF which may be attached to the Panoramic Indicator input. "Tune in" a signal on the companion receiver.

c. Bring the deflection on the Panoramic Indicator to the center of the screen by means of the CENTER FREQ. control. Adjust the GAIN so that the deflection is approximately three divisions high.

d. Gradually rotate the SWEEP WIDTH FACTOR control counterclockwise. If the deflection tends to "walk off" the screen, recenter it with the CENTER FREQ. control.

e. When the scanning width is so reduced that the base of the deflection spreads across the entire screen, carefully center the top of the expanded signal with the CENTER FREQ. control.

NOTE

If the deflection position slowly shifts at reduced scan, the indicator or signal generator may not be completely "warmed up."

f. Return the SWEEP WIDTH FACTOR control to its full clockwise position. The peak will shrink laterally to its normal sharp pattern.

g. If now the peak is not centered, adjust the HORIZONTAL POSITION control to obtain a centered position.

h. Note the position of the CENTER FREQ. pointer knob with respect to the vertical marker above the knob. The CENTER FREQ. control should be set at this position when following the OPERATING PROCEDURE. Correct setting of this control is required mainly to assure proper alignment to the companion receiver I.F. and is seldom used.

CAUTION

Adjustment of the SWEEP WIDTH LIMIT and SYNCH. controls is to be performed only by maintenance personnel.

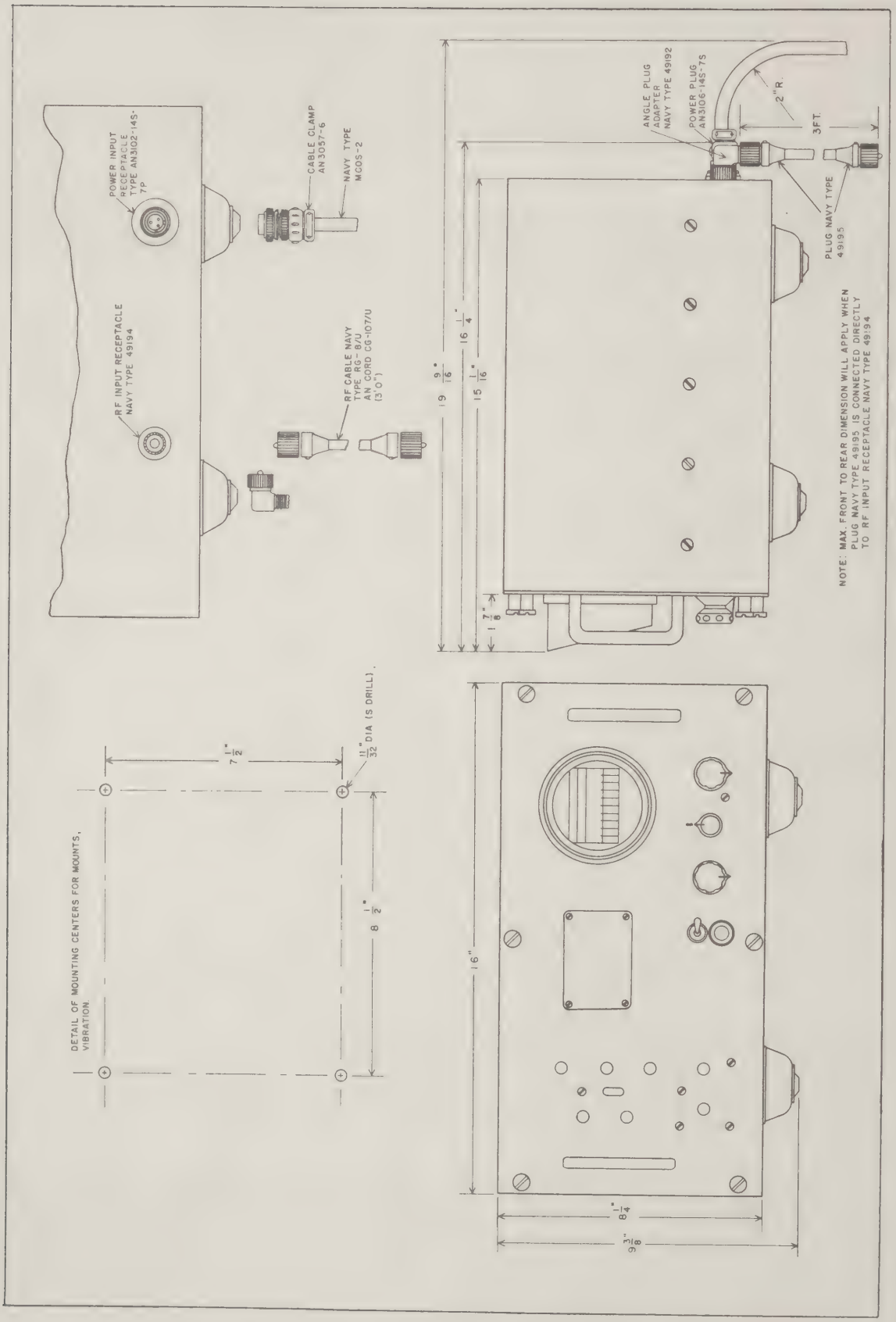


Figure 3-1. Panoramic Indicator IP-206/URR, Installation Drawing

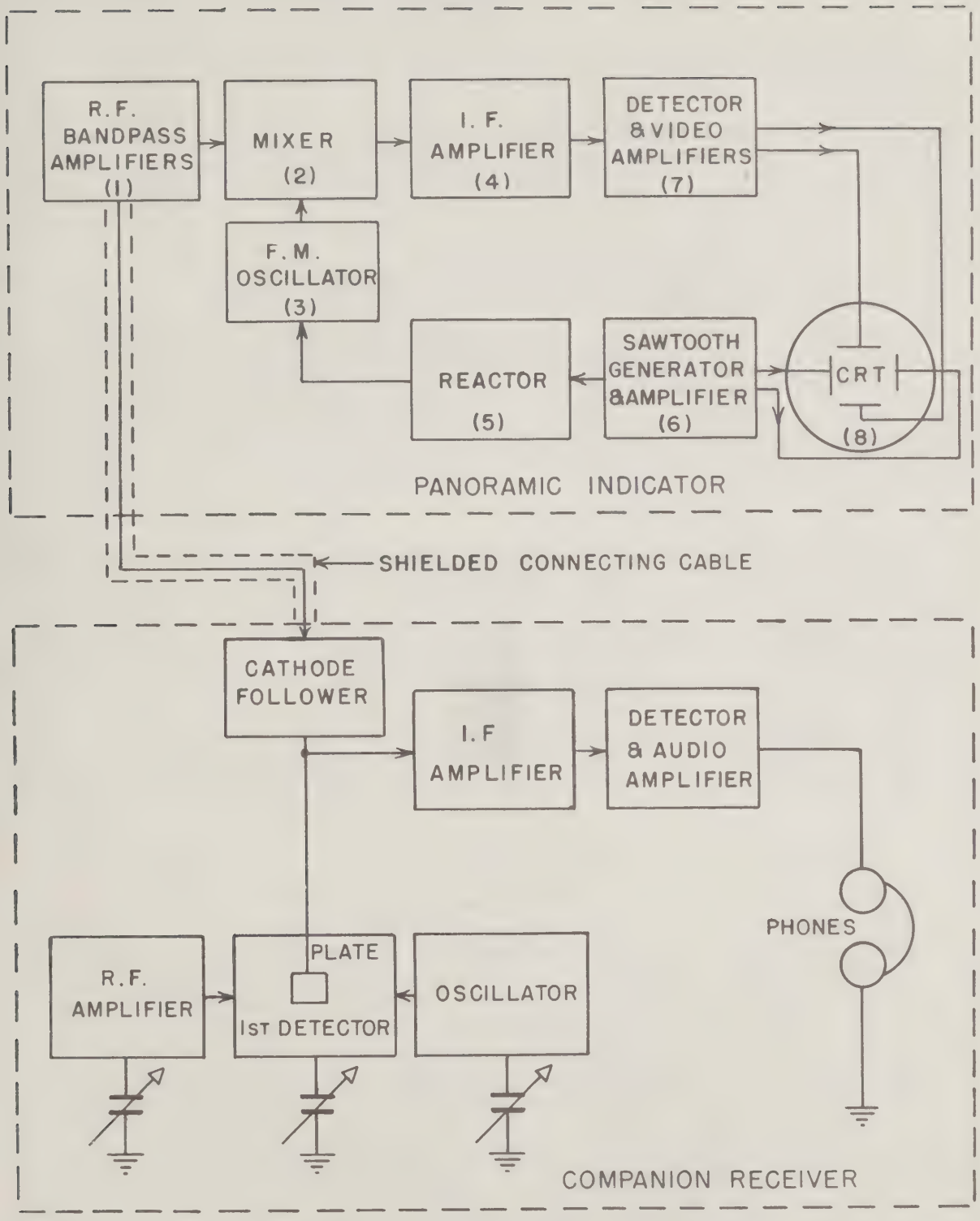


Figure 4-1. Block Diagram

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTORY THEORY.

4-2. The Panoramic Indicator makes possible the simultaneous viewing of a broad band of frequencies as "pips" or deflections on a cathode-ray tube screen. The total visual band available is dependent upon the maximum scanning width of the instrument.

4-3. If a band of frequencies 100KC wide with a central frequency of 3mc were to be examined, its extremeties would be 2.95mc and 3.05mc.

4-4. COMPANION RECEIVER. The companion receiver must be a superheterodyne receiver having an intermediate frequency of approximately 400 kilocycles. In the output of the converter tube of a superheterodyne receiver there are signals whose frequencies extend on either side of the I. F. amplifier frequency. This I. F. amplifier (being very selective) will pass only those signals to which it is tuned, and that is why the operator will hear only one station, in the phones or loud speaker.

4-5. PANORAMIC INDICATOR. The Panoramic Indicator is a complete superheterodyne receiver in itself. The indicator's input is connected to the output of the mixer tube of the companion receiver through a cathode follower. Thus it will receive signals over a relatively wide band. On account of the radio-frequency amplification of the receiver, the signals in the plate of the converter, other than those of its intermediate frequency, will be relatively weak.

The Panoramic Indicator has an input-amplifying stage with a bandpass characteristic which is inverse to that of the receiver (See Fig. 4-2). That is, it amplfies where the receiver attenuates, and vice-versa. When the two units

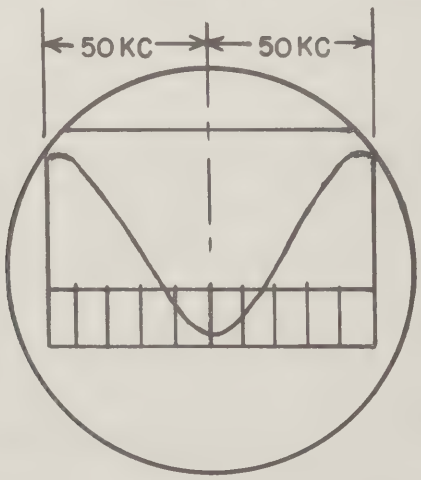


Figure 4-2. Bandpass Characteristics

are used together, the overall bandpass characteristic tends to be uniform through the frequency spectrum. Figure 4-3 (heavy line) is a view of the approximate variation of amplitude of a signal of constant strength, seen on the adaptor screen. As the receiver is tuned to higher frequencies, the side peaks will tend to increase with respect to the center peak. Two traps L102 and Z101 are being used to reject spurious responses. As previously stated, the amplifying characteristic of this R.F. bandpass amplifier, Block 1 in Figure 4-1, is such as to emphasize the bands away from the center frequency, thus amplifying the extremities of the bands more than the center. In this manner partial compensation for the selectivity of the R.F. or preselector stages of the companion receiver is obtained. This compensation will vary with the companion receiver's input frequency.

4-6. The FM oscillator is periodically and automatically varied in frequency above and below its mean frequency by an amount equal to one-half the maximum sweepwidth (when the sweepwidth control is set at maximum). The periodic tuning is effected purely by electronic means. The Reactance Modulator, Block 5 in Figure 4-1, is connected to the local FM oscillator through the proper phase shifting circuits in such a manner as to become part of the tuning elements of the oscillator. By varying the controlling voltage on the grid of the Reactance Modulator tube, the reactance of the tube changes in such a manner as to vary the frequency of the oscillator proportionately to the voltage.

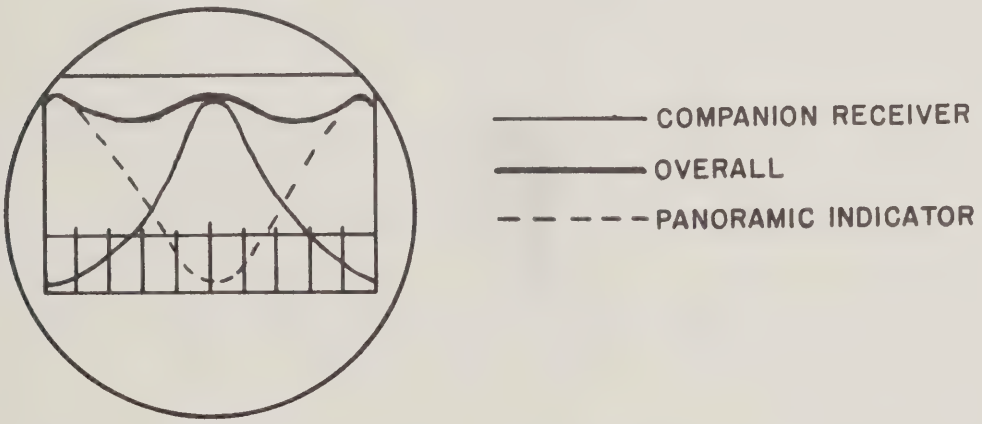


Figure 4-3. Panoramic Indicator, Bandpass Response. Overall response represents composite of the peaking characteristics of the Panoramic Indicator and the companion receiver.

4-7. Such a controlling voltage variation is applied to the grid periodically, at half the line frequency, by tapping off the output of the sawtooth voltage generator and amplifier, Stage 6. See Figure 4-1.

4-8. The maximum limits of the frequency excursion, therefore, are determined by the peak sawtooth voltage applied to the reactance modulator.

4-9. The CENTER FREQ. control governs the bias on the grid of the Reactance Modulator and consequently the mean frequency about which the oscillator swings.

4-10. The output of the FM oscillator, Block 3 in Figure 4-1, and the signals passed by the input stages are mixed in the Mixer Block 2, in Figure 4-1, and the resultant products are applied to the I.F. channel Block 4, in Figure 4-1. This channel is sharply tuned to a specified frequency and will pass and amplify only those frequencies within its bandpass region. Therefore, each incoming signal is passed by the I.F. stage only during the moment when the difference between the incoming signal frequency and the local oscillator frequency, during its excursion, equals the I.F. of the equipment. The I.F. stage, in effect, amplifies a series of voltage pulses produced by the successively heterodyned signals. These pulses are detected and amplified by the detector and video amplifier, Block 7. See Figure 4-1. They are then applied to the vertical deflection plates of the cathode-ray tube.

4-11. The horizontal deflection plates of the CRT are impressed with an amplified sawtooth voltage tapped off the same sawtooth generator which supplied the reactance modulator with sawtooth. Thus, the electron beam in the CRT is swept in a horizontal direction in synchronism with the FM Oscillator. Consequently, each voltage applied to the vertical deflection plates will produce a vertical deflection in its own position along the horizontal axis as the beam sweeps across the face of the tube. The repetitive action of the sawtooth generator causes each deflection to appear in the same place 30 times per second, depending upon the line frequency of the power source. Persistence of vision and screen flourescence create the illusion of constant, steady indications.

4-12. D. C. positioning voltages on the deflection plates are varied by the HORIZONTAL POSITION and VERTICAL POSITION controls. D. C. coupling is used between the detector, video amplifier, and the vertical deflection plates so that low frequency responses can be examined, e.g., hum, noise, fading, etc.

4-13. The screen is equipped with a screen filter which enables optimum visual reproduction of the signals on the screen without being greatly affected by ambient light falling on the face of the cathode-ray tube.

4-14. CIRCUIT ANALYSIS.

4-15. R.F. Bandpass Amplifiers. Refer to the block marked 1 in Figure 4-1. This stage employs a 12AT7, V101, which functions as a cascode R.F. Amplifier.

4-16. The input to this stage consists of an I.F. trap (226KC) and an input step up (untuned) transformer. The output of this stage is fed to an Image Trap (m - derived filter). The Bandpass Amplifier V102 (6AU6) is composed of two stagger tuned circuits in series. These are peaked at 350KC and 450KC respectively. The overall bandpass characteristics of the Panoramic Indicator are shown in Figure 4-2.

4-17. FREQUENCY MIXER AND FM OSCILLATOR. The mixer indicated by Block 2 in Figure 4-1 is not only fed signals which appear across the secondary of Z102 but also a signal of varying frequency from the FM oscillator, Block 3. Refer to Figure 4-1. The mixer is operated in such manner as to produce beat frequencies. A 6BA7, V103, is used as the mixer. The transformer, Z104, in the plate circuit is tuned to pass only the difference frequency, 226KC.

4-18. The frequency of the local oscillator is controlled partially by the inductance and capacticance present in Z103 and partially by the changing inductance due to the action of the reactor tube. The periodic variation of the oscillator frequency occurs over a maximum band of 100KC, the center of which is considered as the oscillator mean frequency, 626KC.

4-19. The signals appearing across Z102 are applied to grid three of V103. The bias for this grid is obtained from the voltage developed across R115 and R117 which is part of the high negative voltage bleeder chain.

4-20. The oscillator is of the grounded plate Hartley variety. It is connected to regulated B+ to obtain oscillator stability. A 6C4W, V107 is used as the local oscillator.

4-21. REACTANCE MODULATOR. The block marked 5 in Figure 4-1 is the reactor. This stage uses a 6AU6, V108, and forms part of the oscillator tuned circuit. In order to achieve frequency modulation of the oscillator, the reactor periodically varies the apparent inductance of the oscillator tank circuit in step with an amplified sawtooth voltage which is applied to the control grid of the reactor tube. The reactor is so designed that the voltage between plate and cathode of V108 and the current from cathode to plate are out of phase with each other just as they would be in a real inductance. The magnitude of the inductance depends upon the amplitude of the voltage applied to the reactor grid. Thus, as the sawtooth voltage rises, the inductance varies following the same periodicity as the sawtooth.

4-22. Center Frequency Control and C.F. Pad R130 and R127 serve to vary the operating point of V108 by altering the bias. In this way, the center frequency deflection on the screen may be shifted in either direction to a certain extent around the zero mark.

4-23. R163, SWEEP WIDTH FACTOR, controls the amplitude of sawtooth voltage applied to the reactor control grid and thereby governs the extent of oscillator excursion. R162, Sweep Width Limit, in series with R163, limits the magnitude of the applied sawtooth, so that when the SWEEP WIDTH FACTOR control is set at maximum, the oscillator excursion does not exceed 100KC.

4-24. INTERMEDIATE FREQUENCY AMPLIFIER. The block marked "4" on Figure 4-1 is the I.F. amplifier stage. It is composed of V104, a 6AU6, Z104, Z105 and a number of associated resistors and condensers.

4-25. The output of the frequency converter, which may contain an assortment of frequencies, is coupled to the control grid of V104 through the double tuned I.F. transformer, Z104. The selectivity of this transformer is such that only a 226KC signal, the frequency to which it is resonant, produces a large voltage between the control grid and cathode of V104. The other frequencies present in the converter circuit are attenuated to a greater or lesser degree, depending upon their frequency separation from 226KC.

4-26. R119 is the I.F. pad. In series with R118 it partially governs the D.C. voltage applied to the screen grid of V104. Hence, it varies the transconductance and, therefore, the gain, of V104.

4-27. DETECTOR. The detector is part of the block marked "7" on figure 4-1. A 6AV6, V105, which is a duplex-diode, high mu triode serves as both the detector and video amplifier. One of the diode plates is employed as a detector rectifier while the other plate is unused. The diode load resistor, develops a rectified signal voltage drop which is subsequently applied to the grid of the triode section of V105.

4-28. The diode detector is directly coupled to the grid of the video section of V105 in order to reduce the loss of gain at low modulating frequencies. Direct coupling also enables indication of a C.W. signal as an elevated baseline when the indicator is operated at zero scanning width. In this case the signal causes a steady D.C. voltage to appear across the diode load resistor.

4-29. VIDEO AMPLIFIER. The video amplifier is part of the block marked "7" in figure 4-1. The triode section of V105, a 6AV6, serves as one-half of a push-pull circuit. One triode section of V109 serves as the other half. The output of the detector is amplified by the triode in V105. This amplified voltage is applied directly to one vertical deflection plate of the cathode-ray tube, V110. A part of the same voltage is fed to the control grid of V109. This partial voltage is made approximately equal to the voltage originally fed to the triode of V105. Since the amplification of V109 is approximately equal to that of V105, the magnitude of the output of V109 is approximately equal to that of V105.

4-30. BLOCKING TUBE OSCILLATOR SWEEP GENERATOR. The block marked "6" on Figure 4-1 contains a sawtooth sweep generator and sawtooth amplifier. A 12AT7 dual triode, V113, is employed for this purpose. The function of the blocking tube oscillator sweep generator is to provide a sawtooth voltage to effect a horizontal sweep of the cathode ray tube beam (thus causing a baseline to appear on the screen) and to modulate the reactor tube so as to sweep the frequency of the local oscillator.

4-31. SAWTOOTH VOLTAGE AMPLIFIER. This section consists of V113, a 12AT7, and V109 which represents one triode section of a 12AT7. The system utilizes a push-pull arrangement to provide signals 180° out of phase to the cathode ray tube deflection plates of V110, 3RP1.

4-32. Potentiometer R132 in series with R133 and R145 constitute a bleeder network across the B+ supply. A variation in resistance of R132 the HORIZONTAL POSITION control produces a voltage variation across R145. This effectively varies the bias on V109 and, therefore, the plate current through V109. Concurrently, there is a variation in the DC voltage across R134, the plate load resistor of V109. Since this voltage is applied only to one deflection plate of the cathode-ray tube, the baseline will be shifted horizontally.

4-33. Potentiometer R136 in series with R137 and R146 constitute a bleeder network across the B+ supply. A variation in resistance of R136, the Vertical Position control produces a voltage variation across R146. This effectively varies the bias on V109 and, therefore, the plate current through V109. Concurrently, there is a variation in the DC voltage across R135, the plate load resistor of V109. Since this voltage is applied only to one deflection plate of the cathode-ray tube, the baseline will be shifted vertically.

4-34. CATHODE RAY TUBE. The cathode-ray tube indicator is a 3RP1.

4-35. R151, a potentiometer, is used to vary the voltage difference between the cathode and grid, thus altering the intensity of the beam. This is the BRILLIANCE control.

4-36. R149 which is used to establish the correct voltage relationship for proper focus. This is the FOCUS control.

4-37. The fluorescent coating of the cathode ray tube may be burned off by over-excitation. Therefore, it is always advisable to operate the indicator with as low a brilliance as possible.

4-38. POWER SUPPLY. The operating voltages for the entire indicator are derived from a single power transformer T102.

4-39. F101 and F102 are 3AG/2A fuses which protect the equipment and line from overload.

4-40. The action of the voltage regulator system depends upon the tendency of gaseous discharge tubes to maintain a constant difference of potential between their elements. V106 is such a tube. The voltage across pins 4 and 5 remain very close to 108 volts, regardless of line fluctuations, provided that a current drain through the tubes is held within the limits set by the tube manufacturer and that the fluctuations in line voltages and loads are not too severe. Regulated voltage is supplied to those circuits in which fluctuation of voltages would cause unstable operation.

SECTION V

TEST EQUIPMENT

5-1 LIST OF TEST EQUIPMENT.

TEST EQUIPMENT REQUIRED FOR MAINTENANCE

Name	Manufacturer's Designation	Alternate	Application
Signal Generator	Measurements Corp. Model 65-B	200-950KC Generator	Align IF, RF and oscillator coils, IF trap and image trap
Multimeter	Triplett 625-NA	20,000 ohm/volt multitester or V.T.V.M	Measure voltages and resistance at sockets and terminal boards.
Oscilloscope	Dumont 304A	Oscillo-scope	Examine sawtooth waveforms. Calibrate oscilloscope by using the filament voltage (18 volts peak to peak approx).
Tube Tester	Hickok 539A	Hickok 540 545 547	Test Vacuum Tubes

SECTION VI

TROUBLESHOOTING AND MAINTENANCE

6-1. PERIODIC INSPECTION AND PREVENTIVE MAINTENANCE.

6-2. At the termination of each 200 hour period, the following checks are to be made:

6-3. MECHANICAL SECURITY. Check all bolts which are used to secure the shock mounts to, the operating position or table.

6-4. CABLES. The R.F. cables should be firmly secured to the proper connectors at both ends. The power cable should be firmly fastened to the indicator and to the power source.

6-5. OPERATIONAL. Check the operational characteristics of the indicator in the following manner:

a. Check the baseline trace and the adjustments of the HORIZONTAL POSITION and CENTER FREQ. controls in accordance with the procedure given in Section III, Operating Checks and Adjustments.

b. Check for synchronization of the sweep frequency to one-half of the power line frequency. This will require removal of the chassis from the cabinet. Disconnect the power cable from the A.C. line and at the chassis end of the cable. Disconnect all R.F. cables. Grasp handles at sides of front panel and pull chassis forward until latch clicks. Lift panel upwards and pull chassis forward above bumpers, mounted on top of sliders. Lift chassis up and off sliders. Remove the bottom plate from the chassis. To check for sweep synchronization feed in through an .01 mfd capacitor the A.C. line frequency present on pin No. 4 of V105 to pin No. 1 of V105. Reconnect the indicator to the power source by means of the power cable. Turn on the power in the indicator. Two peaks will appear on the screen if the sweep frequency is one-half the line frequency. If this condition does not exist, adjust the SYNCH control so that two steady peaks appear.

6-6. VACUUM TUBES, REMOVAL. Remove the tubes in the following order:

a. Remove all the miniature tubes from their respective sockets.

b. Remove V112 carefully by lifting off the bakelite plate cap being careful not to strain the connecting wire.

c. Remove the cathode-ray tube by loosening the clamp which supports the base of the cathode-ray tube. Use a screwdriver. Grasp the socket with one hand. With the other hand press on locating pin (center pin) of the cathode-ray tube gently and slide tube out through hood on front panel. The boot and and screen will accompany tube.

6-7. VACUUM TUBES, TESTING. Check tube characteristics using the following procedures:

a. Check the transconductance of the tube. If the transconductance of any tube is less than it should be, as indicated on the Hickok 539A tube tester, the tube should be replaced.

b. Check the voltage regulator tube for gaseous discharges. If the OB2 fails to glow at a potential of 108 volts and a current drain of less than 30ma, it should be replaced.

6-8. REPLACEMENT OF SEMI-ADJUSTABLE CONTROLS.

a. Remove the two flat head panel screws which fasten the potentiometer bracket spacers to the front panel. Note that there is a flat washer on each spacer which holds the panel slide plate against the panel. Do not lose these washers as the spacers are separated from the front panel. Lift the potentiometer bracket away from the front panel. Position the bracket as required to remove any defective control. Remove C114 if necessary.

b. The BRILLIANCE and FOCUS controls have slotted bakelite insulator couplings. These are removed with an Allen wrench. Carefully unsolder and remove the defective control.

c. After inserting the replacement control, resoldering the connections, fit the spacer into the slots of the panel slide plate. Be sure that the flat washers are remounted on the spacer. Fasten the spacers to the front panel with the flat head screws.

d. To return chassis to cabinet, pull sliders all the way forward. Place rear rollers of chassis on slider. Keeping chassis almost level, push forward until latch plate (left side of chassis) clears cabinet and front rollers are on slider. Release latch lock (left side of cabinet) by pressing downward. The panel can now be pushed forward until it is flush with the cabinet. Tighten the six slotted thumb screws on the front panel. Refer to Figure 6-1 for location of latch plate and latch lock.

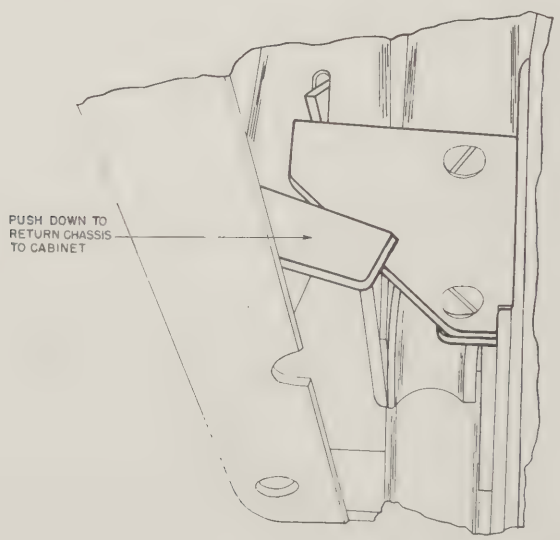


Figure 6-1. Chassis Lock Mechanism

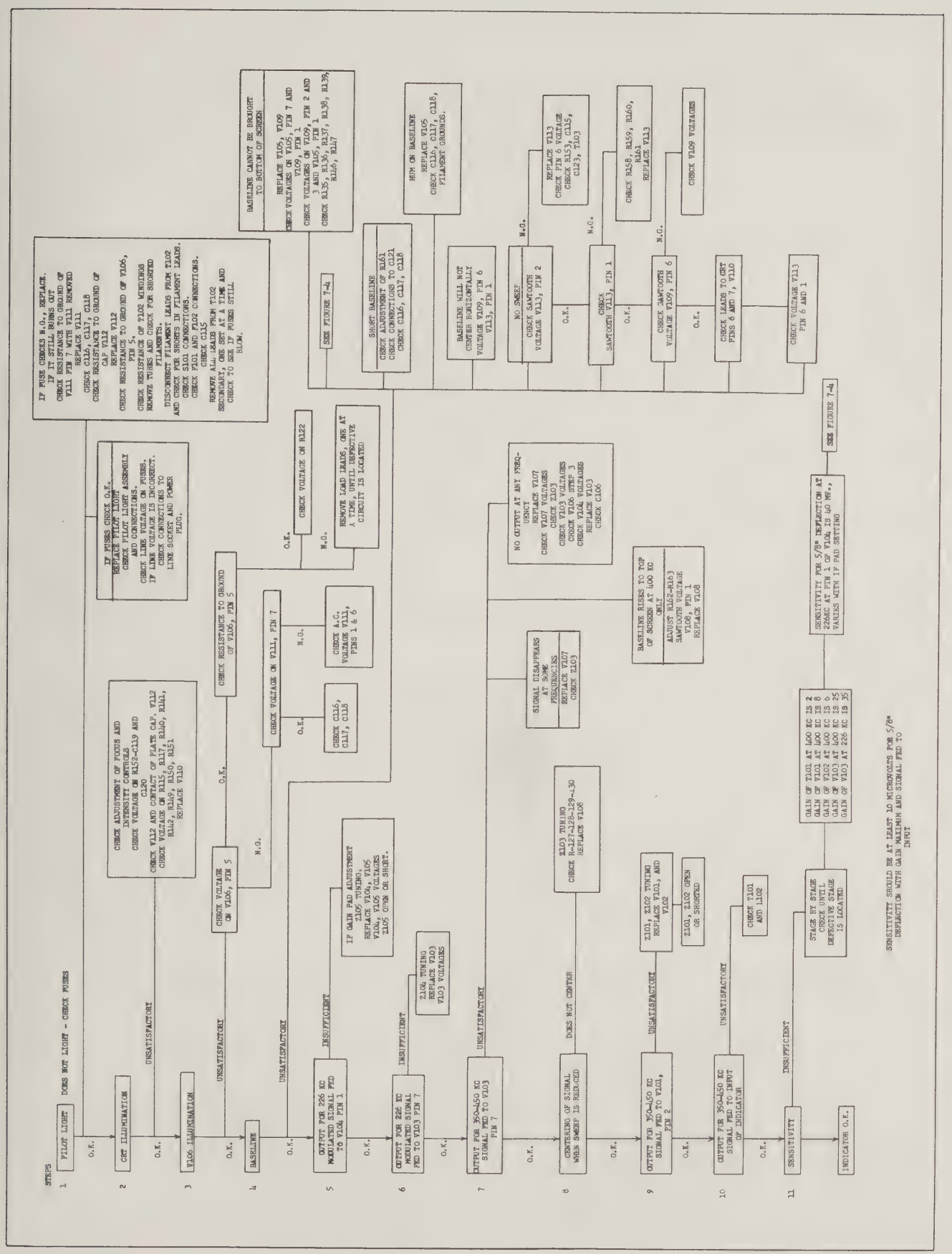


Table 6-2. Trouble Shooting Chart

SECTION VII

ALIGNMENT AND TESTING

7-1. ALIGNMENT.

7-2. Before alignment of the Panoramic Indicator is attempted, the instrument should be allowed to "warm up" for at least one-half hour.

7-3. It will be noted that when signals between 350KC and 450KC are fed from a Measurements Corp. Model No. 65B Signal Generator into the indicator, the screen calibration signs are reversed. The higher frequencies appear on the minus side and the lower frequencies on the plus side. This is normal.

7-4. Coils and transformers Z101, Z102, Z103, Z104, Z105 and L102 are tuned by means of movable iron cores. The "T" windings can be tuned at the top of the coil by means of a screwdriver. Windings "B" can be tuned from the bottom of the coil by using a screwdriver tip. They may be reached by removing the plug buttons from the bottom plate. When windings "T" are tuned from the top, the dust cover on the shield can be moved aside, and the screwdriver tip is passed through. The tip will engage in a slot on the top of the top core. Transformer Z103, the oscillator coil, is tuned by a bottom core, which can be adjusted from either the top of the coil or the bottom.

7-5. I. F. ALIGNMENT.

7-6. Align the I.F. Section and IF trap L102 by using the following procedure:

a. From a Measurements Corp. Model No. 65B Signal Generator feed an unmodulated 226KC signal to J101, the input receptacle. Set the SWEEP WIDTH FACTOR control at minimum and GAIN to maximum.

b. Adjust the upper and lower cores of transformers Z105 and Z104 with a screwdriver until a maximum vertical rise of the baseline trace on the cathode ray tube screen is obtained. In order to identify the maximum rise the elevated baseline trace should be kept on the screen by adjusting the signal generator output level as needed.

c. Adjust L102 for minimum deflection. The signal generator should be maintained at the same frequency as steps a and b.

d. From a Measurements Corp. Model No. 65B Signal Generator feed in unmodulated 400 KC signal to J101.

e. Set the Sweep Width Factor control about one third fully clockwise. Set the GAIN and CENTER FREQ. controls so that a pip similar to Fig. 7-1 appears on the indicator screen.

f. If pip is not symmetrical,"touch up" the bottom and top cores of Z104 and Z105. Slight or no adjustment should be necessary.

g. The resolution of the indicator is measured at maximum sweep width (100 KC). Two signals, 397.5KC and 402.5KC, of equal amplitude are fed to J101. Refer to Fig. 7-2. The signals should intersect at point lower than 30% of the pip height. Resolutions is defined as the frequency separation of the pips for an intersection at 30%.

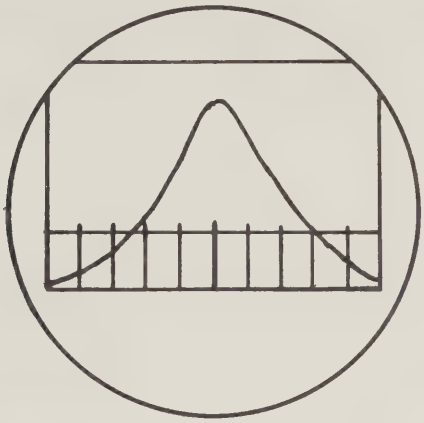


Figure 7 - 1. Symmetrical Single Peak Deflection

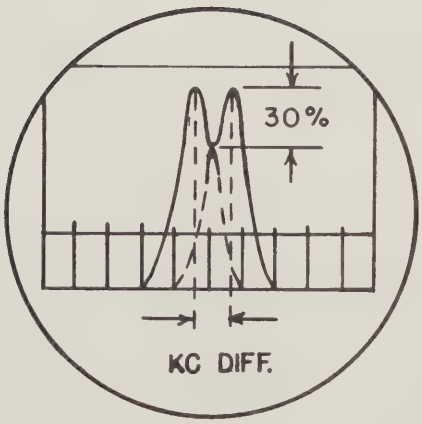


Figure 7-2. Resolution

7-7. F.M. OSCILLATOR ALIGNMENT PROCEDURE.

7-8. The following adjustments are a series of approximations which are narrowed down until the desired results are obtained. The signal voltages are fed into the RF input connectors during this entire procedure.

7-9. CENTER FREQUENCY ALIGNMENT. Generally adjustment of the oscillator tuning core, available through the top of the FM oscillator coil, is sufficient. If, however, all of the controls are out of adjustment, proceed as follows:

a. A 400KC signal from Measurements Corp. Model No. 65-B Signal Generator is used.

b. Set the SWEEP WIDTH FACTOR control at maximum.

c. Set the CENTER FREQ. control at the panel marker. If the knob set screws have been disturbed, reset the knob pointer to the panel marker when the control is at the mid-point of its rotational range.

d. Adjust the C.F. Pad, R127 of the FM oscillator so that the deflection on the screen is centered.

e. Gradually rotate the SWEEP WIDTH FACTOR control counterclockwise toward its minimum position and at the same time maintain the deflection at its centered position by readjusting the C.F. PAD, R127. When the SWEEP WIDTH FACTOR control is at its minimum position, a straight line due to the input signal should appear well up on the screen. Trim the C.F. PAD slightly to raise the line to the highest possible level.

f. Bring the SWEEP WIDTH FACTOR control back to maximum. A symmetrically centered curve should appear exactly at the zero mark on the screen. If the curve is not centered, adjust the HORIZONTAL POSITION control until centering is achieved. Refer to Figure 7-1.

7-10. LOW FREQUENCY ALIGNMENT. Alignment of low frequency linearity is accomplished in the following manner:

a. A 350KC signal is used.

b. Keep the SWEEP WIDTH FACTOR control at maximum.

c. Adjust the core "B" of Z103 until the deflection appears on the screen at the +50 mark. Some adjustment of the SWEEP WIDTH LIMIT may be necessary.

7-11. Repeat Center Frequency Alignment, Para. 7-9.

7-12. HIGH FREQUENCY ALIGNMENT. Alignment of high frequency linearity is obtained in the following manner:

a. A 450KC signal is used.

b. Keep the SWEEP WIDTH FACTOR control at maximum.

c. Adjust the SWEEP WIDTH LIMIT until the deflection appears on the screen at the -50 mark.

7-13. Repeat Center Frequency Alignment.

7-14. Repeat Low Frequency Alignment.

7-15. Repeat Center Frequency Alignment, Low Frequency Alignment and High Frequency Alignment until scale calibration is satisfactory.

7-16. RF ALIGNMENT PROCEDURE.

7-17. Align the RF Section of the indicator by using the following procedure:

a. Feed in a 852KC signal into J101 connector. Set the SWEEP WIDTH FACTOR control at a maximum. Adjust the upper and the lower cores of Z101 for minimum deflection.

b. Feed in a 350KC signal into J101 connector. Adjust bottom core of Z102 for maximum pip height.

c. Feed in a 450KC signal into J101 connector. Adjust top core of Z102 for maximum pip height.

7-18. SENSITIVITY.

7-19. SENSITIVITY ADJUSTMENT. Feed in a 400KC signal of 10 microvolts into J101 connector, with approximately 45 ohms in series with the signal generator. This is done to duplicate a 50 ohm source. The Measurements 65B has an impedance of approximately 5 ohms. With the GAIN and SWEEPWIDTH FACTOR controls set for maximum (clockwise) adjust I.F. PAD (R119) for 5/8" pip height.

7-20. IMAGE REJECTION RATIO.

7-21. Feed in a 400KC signal into J101 connector, with approximately 45 ohms in series with the signal generator. Set the GAIN and SWEEP WIDTH FACTOR controls at maximum. Adjust the signal level for a full scale pip and note voltage of the signal generator.

7-22. Feed in 852KC and adjust the signal output for a full scale pip. Note the voltage of the signal generator. The ratio of the latter voltage to the former represents the image rejection ratio. It should be 10:1 or greater at 400KC.

7-23. I.F. REJECTION RATIO

7-24. Feed in a 400KC signal into J101 connector, with approximately 45 ohms in series with the signal generator. Set the GAIN and SWEEP WIDTH FACTOR controls at maximum. Adjust the signal level for a full scale pip and note voltage of the signal generator.

7-25. Feed in 226KC and adjust the signal output for a full scale pip. Note the voltage of the signal generator. The ratio of the latter voltage to the former represents the I.F. rejection ratio. It should be 10:1 or greater at 400KC.

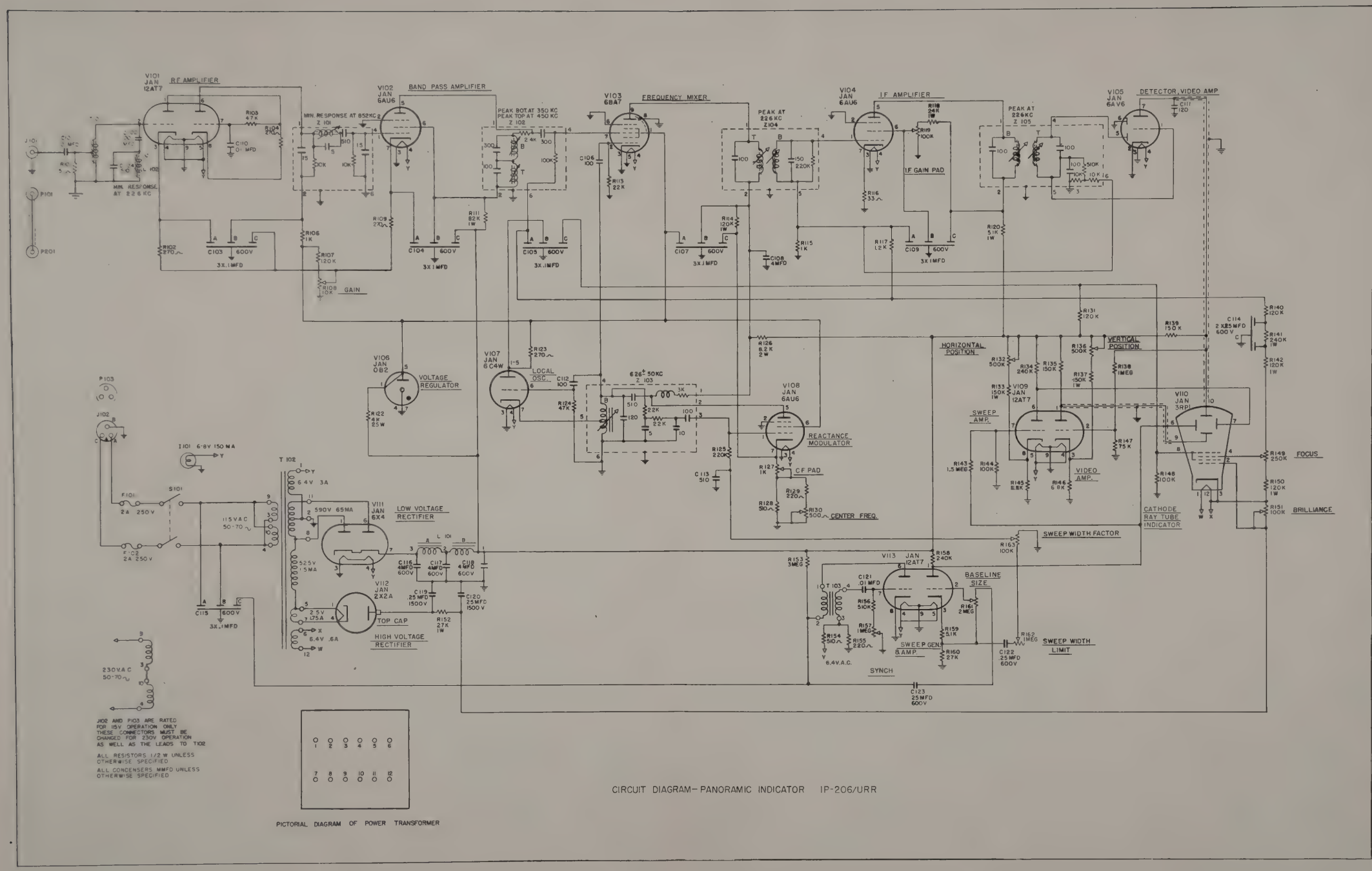


Figure 7-3. Panoramic Indicator IP-206/URR, Circuit Diagram

WAVE FORMS

SWEEP WIDTH FACTOR AND GAIN SET COMPLETELY CLOCKWISE. ALL OTHER CONTROLS SET FOR NORMAL OPERATION. A SIGNAL OF 25 UV AT 400 KC SHOULD BE FED TO THE INPUT. THE VIDEO SIGNALS SHOWN ARE FOR FULL SCALE DEFLECTION ON INDICATOR SCREEN. THE OSCILLOSCOPE SWEEP RATE SHOULD BE SET AT 15CPS.

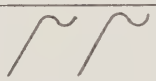
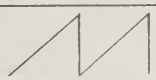
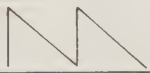
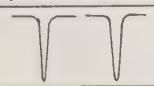
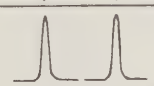
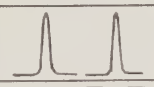
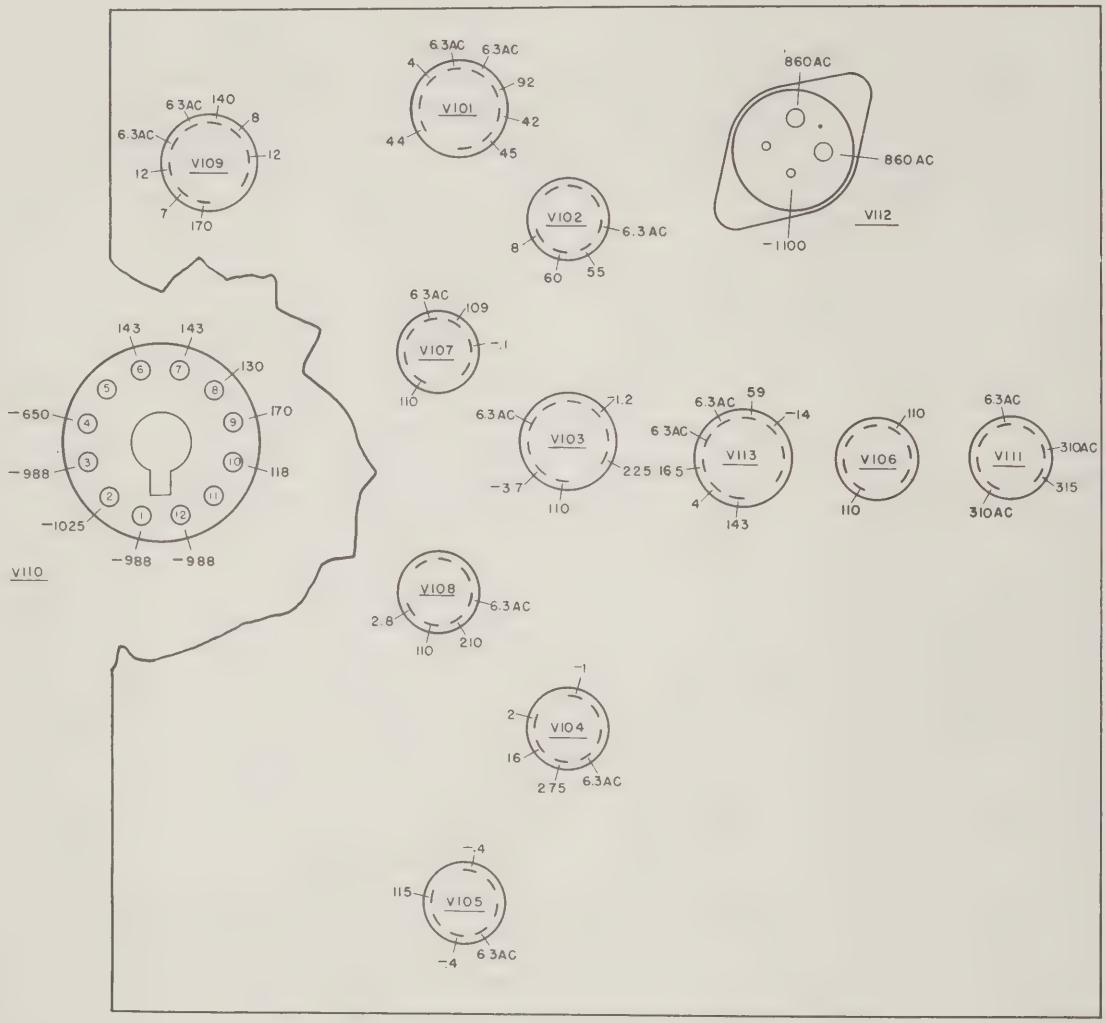
PART DESIGNATION	PIN #	PEAK TO PEAK VOLTS	WAVE SHAPE
T 105	#1 OR #2	21 V.	
T 105	# 3	6 V.	
V 113. 12AT7	# 7	160 V.	
V113 12AT7	# 1	85 V.	
V113 12AT7	# 2	15 V.	
JUNCTION OF R159 AND R160		14 V.	
R162 SWEEP WIDTH LIMIT	CENTER TAP	5 V.	
V 108 6AU6	# 1	5 V.	
V109 12AT7	# 7	7 V.	
V109 12AT7	# 6	85 V.	
V109 12AT7	# 1	85 V.	
V109 12AT7	#2	7 V.	
V105 6AV6	# 7	80 V.	
V105 6AV6	# 1	2 V.	

Figure 7-4. Panoramic Indicator IP-206/URR, Wave Shapes



LINE VOLTAGE — 115 VOLTS, 60CPS

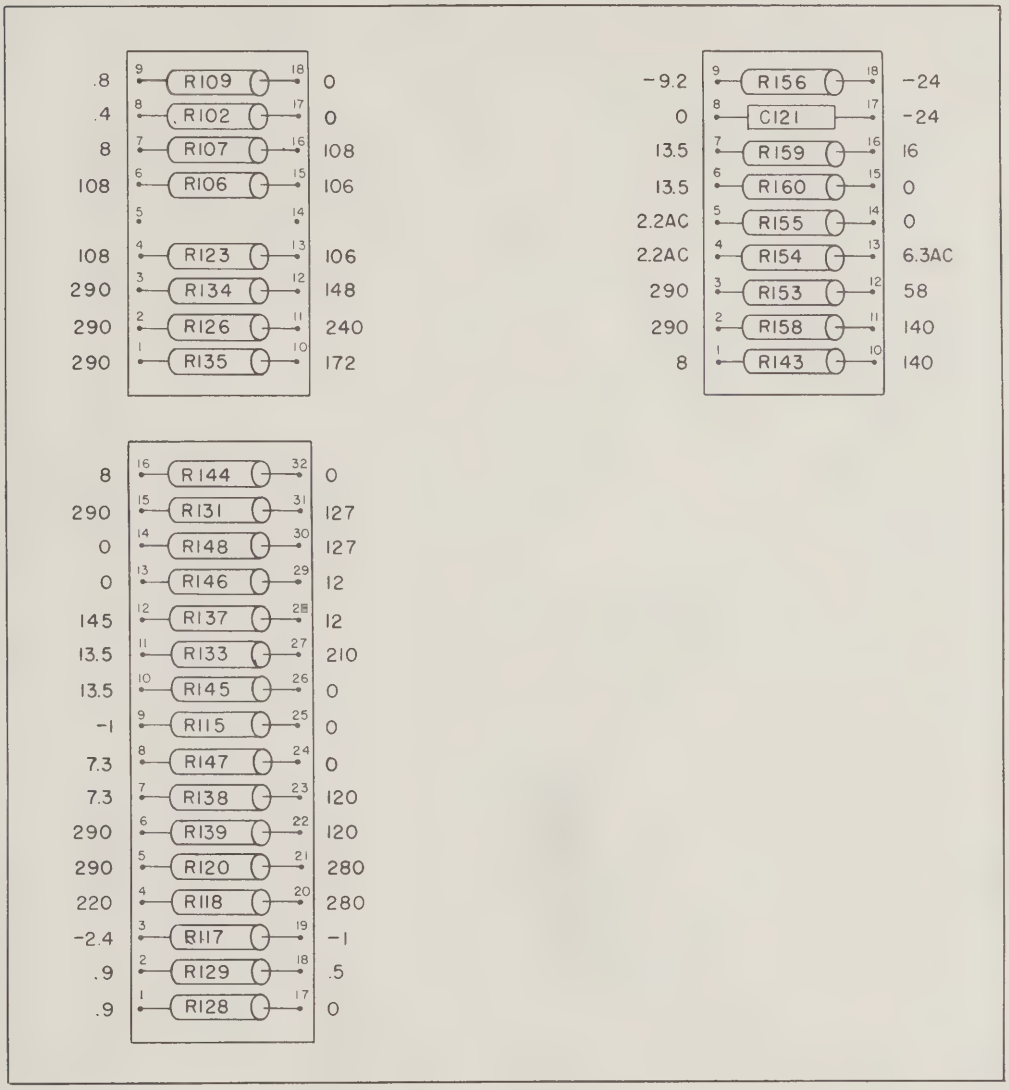
SWEEP WIDTH FACTOR AND GAIN CONTROLS SET AT MAXIMUM.

ALL OTHER OPERATING CONTROLS SET FOR NORMAL OPERATION.

ALL SOCKETS SHOWN ARE VIEWED FROM BOTTOM.

20,000 OHMS / VOLT METER

Figure 7-5. Panoramic Indicator IP-206/URR, Voltages from Tube Socket Terminals to Ground



LINE VOLTAGE = 115 V., 60 CYCLES

ALL VOLTAGES ARE D.C. EXCEPT WHERE OTHERWISE INDICATED.

ALL VOLTAGES ARE MEASURED FROM TERMINAL LUGS TO CHASSIS GROUND.

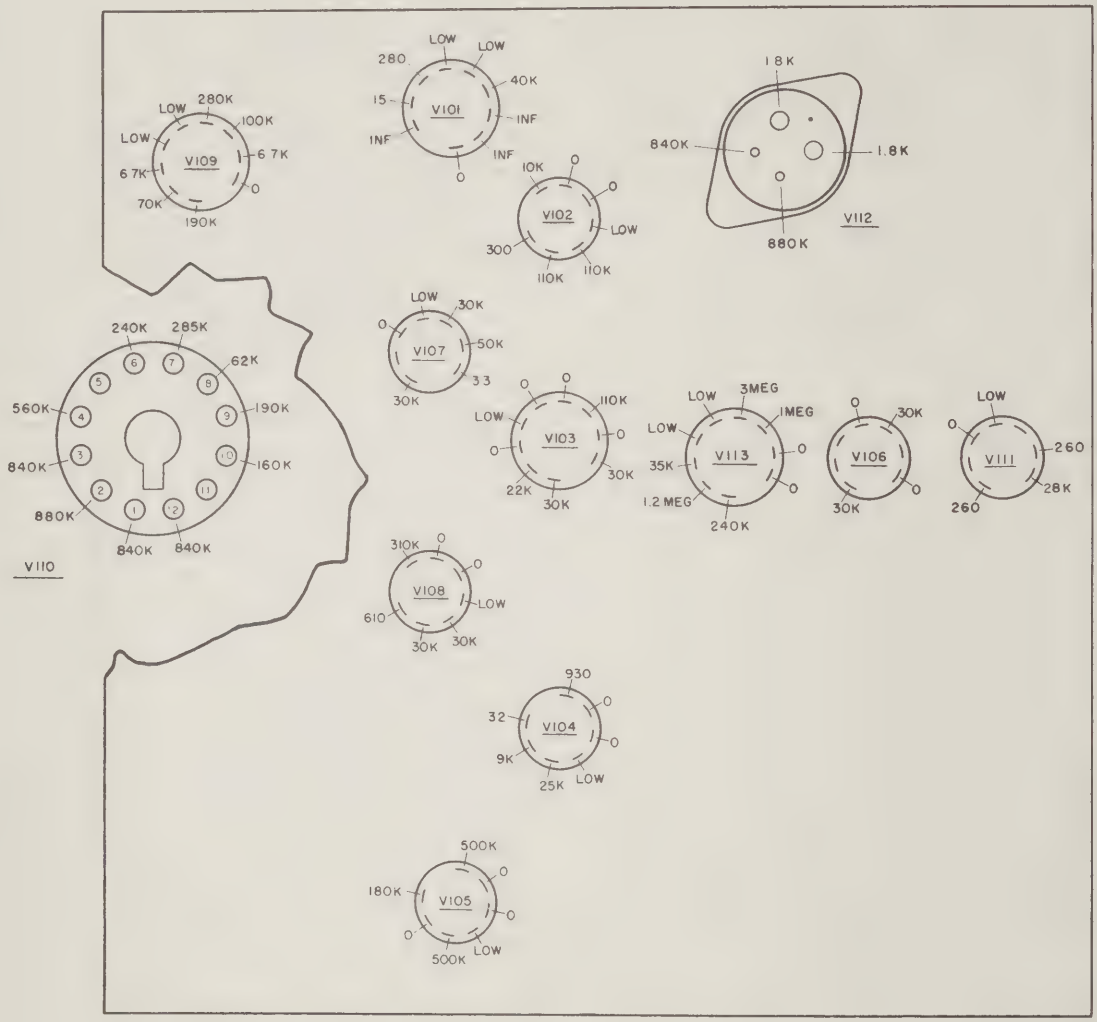
SWEEP WIDTH FACTOR AND GAIN CONTROLS SET AT MAXIMUM.

ALL CONTROLS SET FOR NORMAL OPERATION. NO SIGNAL.

ALL D.C. READINGS MEASURED ON 20,000 OHM/VOLT D.C. METER.

ALL A.C. READINGS MEASURED ON 1,000 OHM/ VOLT A.C. METER.

Figure 7-6. Panoramic Indicator IP-206/URR Voltages at Terminals of Main Resistor Boards



SWEEP WIDTH FACTOR AND GAIN CONTROLS SET AT MAXIMUM.

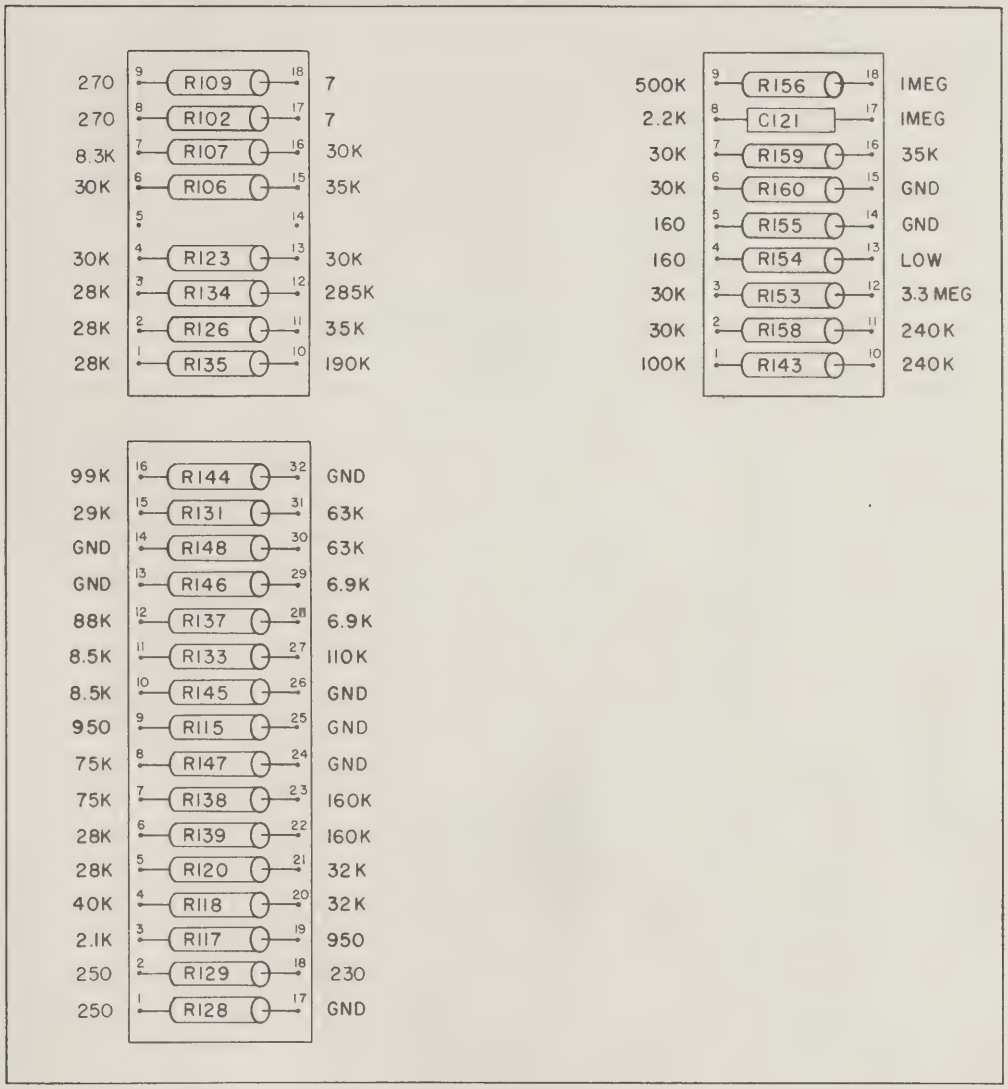
ALL OTHER OPERATING CONTROLS SET FOR NORMAL OPERATION.

ALL SOCKETS SHOWN ARE VIEWED FROM BOTTOM

ALL RESISTANCES IN OHMS. K=1,000 OHMS MEG=1,000,000 OHMS

POWER SWITCH OFF

Figure 7-7. Panoramic Indicator IP-206/URR, Resistances from Tube Socket Terminals to Ground



ALL RESISTANCES MEASURED FROM TERMINAL LUG TO GROUND.

SWEEP WIDTH FACTOR AND GAIN CONTROLS SET AT MAXIMUM.

ALL OTHER OPERATING CONTROLS SET FOR NORMAL OPERATION.

ALL RESISTANCES IN OHMS. K=1,000 OHMS MEG=1,000,000 OHMS

POWER SWITCH OFF

Figure 7-8. Panoramic Indicator IP-206/URR, Resistance at Terminals of Main Resistor Boards

PANORAMIC INDICATOR

IP-206/URR

SECTION VIII

PARTS LIST

Table 8-1. Table of Replaceable Parts

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
A101	----	MOUNT, VIBRATION: aluminum; lacquer finish; attached to bottom of cabinet by means of four mounting holes and to supporting surface by means of center sleeve with 1/4 in. bolt; CPN # G1017; CAXP Type 150PH-12	Support Panoramic Indicator and minimize the effects of mechanical shock
A102	----	MOUNT, VIBRATION: same as A101	
A103	----	MOUNT, VIBRATION: same as A101	
A104	----	MOUNT, VIBRATION: same as A101	
A105	----*	ABSORBER, SHOCK: black rubber; hollow cylinder, slips over 1/4 in. dia. stud part of chassis slide A112; Grant Pulley & Hardware X314 Part of 306 slide; CPN # A2001	Top bumper on chassis slide
A106	----*	ABSORBER, SHOCK: same as A105	Top bumper on chassis slide
A107	----*	ABSORBER, SHOCK: black rubber; rectangular with through hole at one end, slips over 1/4 in. stud; Grant Pulley & Hardware X919 Part of 306 slide; CPN # A2002	Bottom bumper on chassis slide
A108	----*	ABSORBER, SHOCK: same as A107	Bottom bumper on chassis slide
A109	----*	COVER: aluminum; iridite finish; mounted by means of three 6:32 screws; CPN # A26028A	Cover for oscillator shield
A110	----*	COVER: aluminum iridite finish; fastened to chassis with three 8:32 screws and six 6:32 screws and nuts; CPN # A36050B	Cover bottom Panoramic Indicator chassis
A111	----*	CHASSIS: aluminum iridite finish; includes three elastic stop nuts to fasten bottom plate; CPN # A45992	Mount components
A112	----	CHASSIS SLIDE: left; ball bearing type, steel cadmium plated, mounted to chassis slide bracket with five 8:32 flat head screws; part of Grant Pulley & Hardware #306 slide; CPN # A36040	Allows chassis to be pulled out almost full length and remain horizontal for maintenance
A113	----	CHASSIS SLIDE: right; ball bearing type, steel cadmium plated, mounted to chassis slide bracket with five 8:32 flat head screws; part of Grant Pulley & Hardware #306 slide; CPN # A36041	Allows chassis to be pulled out almost full length and remain horizontal for maintenance

* Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
A114	-----	ROLLER: steel; cadmium plated; part of Grant Pulley & Hardware #306; CPN # A16036	Allows chassis to "ride on" slider
A115	-----	ROLLER: same as A114	
A116	-----	ROLLER: same as A114	
A117	-----	ROLLER: same as A114	
A118	-----	"L" BRACKET: aluminum; iridite finish, one tapped 6:32 insert riveted to bracket; CPN # A16022	Mount resistor board
A119	-----	ANGLE BRACKET: aluminum; iridite finish, Z shape, two tapped 6:32 inserts riveted to bracket; CPN # A16021	Mount resistor board
A120	-----	SLIDE SPACING PLATE: aluminum; iridite finish, five mounting holes; CPN # A26027	Spacer between chassis slide bracket and slider
A121	-----	SWEPT OSCILLATOR SHIELD PART I: aluminum; iridite finish, attached to chassis with four 6:32 screws and nuts, two tapped 6:32 inserts riveted to shield; CPN # A26029	Shield oscillator section
A122	-----	CHASSIS SLIDE BRACKET: aluminum; iridite finish mounted to side and bottom of cabinet; CPN # A36030	Hold slider mechanism in place
A123	-----	Same as A122	
A124	-----	CHASSIS LOCATING PIN BRACKET: steel; cadmium plated, iridite finish, U shape; CPN # A16045	Hold chassis locating pin in place
A125	-----	CHASSIS LOCATING PIN: aluminum; iridite finish, cylindrical shape one elastic stop nut; CPN # A16047	Positions rear of chassis against back of cabinet
A126	-----	CHASSIS LOCATING SPRING: steel; cadmium plated; CPN # A16046	Pin loading spring
A127	-----	SIDE BRACKET: left; aluminum, iridite finish; CPN # A36042	Fasten front panel to chassis
A128	-----	SIDE BRACKET: right; aluminum, iridite finish; CPN # A36043	Fasten front panel to chassis

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
A129	-----	CHASSIS LOCK LEVER: aluminum; iridite finish, one #8 elastic stop nut; CPN # A26054 Part 1	Retains chassis in cabinet in "out" position
A130	-----	CHASSIS LOCK PLATE: aluminum; iridite finish; CPN # A26054 Part 2	Mounted on side bracket, retains chassis in cabinet in "out" position
A131	-----	PIVOT STUD: aluminum, iridite finish; CPN # A16055	Pivot for lever
A132	-----	CHASSIS, LOCK LEVER SPRING: steel, cadmium plated; CPN # A16074	Returns lever to normal position
A133	-----	CABINET ASSEMBLY: aluminum; fine grey wrinkle; CPN # A26052	Cover and shield chassis
A134	-----	PANEL: aluminum; fine grey wrinkle, hood for cathode ray tube is flat black on inside and welded on to panel; CPN # A26177	Mount indicators and controls and support chassis
A135	-----	CATHODE RAY TUBE YOKE: dural; iridite finish, semi-circular shape, part of cathode ray tube shield assembly; CPN # A16057	Support cathode ray tube
A136	-----	CATHODE RAY TUBE SHIELD SUPPORT BRACKET: steel; iridite finish, Z shape, part of cathode ray tube shield assembly; CPN # A16081	Support cathode ray tube shield
A137	-----	Omitted	
A138	-----	SLIDE PLATE: aluminum, fine grey wrinkle finish; CPN # A16222	Covers hole of front panel semi-adjustable controls
A139	----- *	CATHODE RAY TUBE CLAMP ASSEMBLY: steel, cadmium plated, iridite finish; CPN # A16091	Hold cathode ray tube in place
A140 A141 A142 A143 A144	-----	SNAP BUTTON HOLE PLUGS: steel iridite finish; firm grip spring action prongs, fits 1/2" hole diameter; CPN # A2003	Shield chassis

* Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
C101	----	CAPACITOR, FIXED, MICA DIELECTRIC: tan; 10,000 mmf, ±10%, 500 working V DC; CMF # CM33B103K; CPN # CM35B103K	Coupling input to T101
C102	----	CAPACITOR, FIXED, MICA DIELECTRIC: silver; 1,000 mmf, ±5%, 500 working V DC; CMF # CM25E102J; CPN # CM25E102J	Part of IF trap
C103	----	CAPACITOR, FIXED, PAPER DIELECTRIC: three sections; 100,000 mmf per section, +20% -10% tolerance; 600 working V DC; hermetically sealed metal case; Dykanol "G" synthetic oil impregnated; common side of each section internally connected to case; CD # CD-CP-55-B5FF104V; CPN # CP55B5FF104V-4	A- Cathode bypass of V101; R.F. Amplifier B- Plate bypass decoupler of V101 C- Cathode bypass of V101 and V102; R.F. amplifer and Bandpass Amplifier
C104	----	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C103	A- Cathode bypass of V102; Bandpass Amp. B- Screen bypass of V102 C- Plate bypass decoupler of V102
C105	----	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C103	A- Grid bypass decoupler of V103; Frequency Mixer B- Plate bypass of V107; local oscillator C- Screen bypass of V110; cathode ray tube indicator
C106	----	CAPACITOR, FIXED, MICA DIELECTRIC: silver mica; 100 mmf, ±5%; 500 working V DC; CMF # CM20-D101J; CPN # CM20D101J	Local oscillator coupling; grid of V103; Frequency Mixer
C107	----	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C103	A- Screen bypass of V103; Frequency Mixer B- Plate bypass decoupler of V103; Frequency Mixer C- Cathode bypass of V108; reactance modulator

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
C108	----	CAPACITOR, FIXED, PAPER DIELECTRIC: one section; 4 mf ±10% 600 working V DC; hermetically sealed metal case; Dykanol "G" synthetic oil impregnated; one side of capacitor internally grounded to case; CD # CP40-C2FF405K; CPN # CP40C2FF405K	D.C. Filter for plate voltage of V103; Frequency Mixer
C109	----	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C103	A- Grid bypass decoupler of V104; IF Amplifier B- Screen bypass of V104; IF Amplifier C- Plate bypass decoupler
C110	----	CAPACITOR, FIXED MICA DIELECTRIC: same as C101	Grid bypass of V101; RF Amplifier
C111	----	CAPACITOR, FIXED, MICA DIELECTRIC; silver mica; 120 mmf, ±5%; 500 working V DC; CMF # CM20D121J; CPN # CM20D121J	Video bypass plate of V105; Video Amplifier
C112	----	CAPACITOR, FIXED, MICA DIELECTRIC: same as C106	Grid leak of V107; Local oscillator
C113	----	CAPACITOR, FIXED, MICA DIELECTRIC: Silver mica; 510 mmf, ±5%; 500 working V DC; CMF # CM20D511J; CPN # CM20D511J	Grid bypass decoupler of V108; reactance modulator
C114	----	CAPACITOR, FIXED, PAPER DIELECTRIC: two sections; 250,000 mmf per section, +20% -10% tolerance; 600 working V DC; hermetically sealed metal case; CD # CDCP54B4FF254V; CPB # CP54B4FF254V-4	D.C. filter for negative bias supply
C115	----	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C103	A- Line voltage filter B- Line voltage filter C- Charging Condenser of V113; Sawtooth Sweep Generator
C116	----	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C108	D.C. filter; cathode of V111; Low Voltage Rectifier
C117	----	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C108	D.C. filter; Low Voltage

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
C118	----	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C108	D.C. filter; Low Voltage
C119	----	CAPACITOR, FIXED, PAPER DIELECTRIC: one section; 250,000 mmf, ±10% tolerance; 1,500 working V DC; hermetically sealed metal case; Dykanol "G" synthetic oil impregnated; one side of capacitor internally grounded to case; CD # CD-CP40C2FH254K; CPN # CP40C2FH254K-4	D.C. filter; High Voltage
C120	----	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C119	D.C. filter; High Voltage
C121	----	CAPACITOR, FIXED, MICA DIELECTRIC: same as C101	Blocking oscillator grid leak of V113; Sawtooth Sweep Generator
C122	----	CAPACITOR, FIXED, PAPER DIELECTRIC: one section; 250,000 mmf, +20% -10% tolerance; 600 working V DC; hermetically sealed metal case; Dykanol "G" synthetic oil impregnated; no internal ground connections; CD # CD-CP54B1FF254V; CPN # CP54B1FF254V-4	Sweep Coupling; Cathode circuit of V113 Sweep Amplifier
C123	----	CAPACITOR, FIXED, PAPER DIELECTRIC: 250,000 mmf, +20% -10% tolerance; 600 working V DC; hermetically sealed metal case, mineral oil impregnated; no internal ground connections; CGF # 7058B; CPN # CP52B1XF254V-5	Sweep Coupling; grid circuit of V113 Sweep Amplifier
C124	----	CAPACITOR, FIXED, MICA DIELECTRIC: same as C113	Part of IF trap
E101	---- *	TOOL, ALIGNMENT: bakelite rod body; one end has steel pin, other end is wedge shaped; CPN # E1010b	Aid in alignment of oscillator coil
E102	---- *	KNOB: round; phenolic material; black; accommodates round 1/4 in. dia. shaft 2 set-screws; brass insert; CAUP Type RE10-F479F Type A; CPN # E3002; knob has molded pointer extending 5/8 in. from center	To adjust R163 (Sweep Width Factor control)
E103	----	KNOB: same as E102	To adjust R108(Gain control)

* Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
E104	----	KNOB: round; phenolic material; black; accommodates round 1/4 in. dia. shaft, 2 set-screws; overall dimensions excluding pointer: 11/16 in. dia, 13/32 in. high; has molded pointer extending 1/2 in. from center; Harry Davies Molding Co. Type 1400L; CPN # E3004	To adjust R130 (Center Frequency control)
E105	----	CLIP, ELECTRICAL: grid plate style; clip material: copper, cadmium plated; phenolic insulated body; CYA Type 91T1NL; CPN # K1001	Connect high voltage filter to plate of V112
E106	----*	INSULATOR, KNOB: linen base bakelite, tan color; cylindrical shaped; one end has 17/64 in dia round hole; other end has screw driver slot; two 8/32 set screws; CPN # K1024	To adjust R151 (Brilliance control) and insulate its shaft
E107	----	INSULATOR, KNOB: same as E106	To adjust R149 (Focus control) and insulate its shaft
E108	----*	INSULATOR, PLATE: paper base bakelite, XXX grade, varnish impregnation; flat rectangular shape, 1-1/2 in. width, 1/4 in. thick, 5-11/16 in. long; 3 #18 drill mounting holes; has 32 solder lug terminals; CPN # K1015Pd	Mount fixed composition resistors and mica dielectric capacitors
E109	----*	INSULATOR, PLATE: paper base bakelite, XXX grade, varnish impregnation; flat rectangular shape, 1-1/2 in. width, 7/16 in. thick, 3-3/8 in. long; 3 #18 drill mounting holes; CPN # K1016Pd	Mount fixed composition resistors and mica dielectric capacitors
E110	----*	INSULATOR, PLATE: same as E109	Mount fixed composition resistors and mica dielectric capacitors
E111	----*	INSULATOR STAND OFF: XXX grade, bakelite; paper base; varnish impregnated; flat rectangular shape 5-3/4" long x 2-1/2" wide; CPN # K26035A	Mount for 7 semi-adjustable parts
E112	----	SHIELD, ELECTRON TUBE: made of silicon steel; cylindrical; with clamp holding CRT base; dim. 4 in. dia. x 8-1/4 in. long; clamp mounted; CPN # A26039	Cathode Ray Tube Shield Assembly
E113	----*	CONTACT, ELECTRICAL: phosphor bronze, silver plated; length 2 in., width 2 in., height 5/16 in.; maximum useable clearance 1/4"; surrounds connector; mounting four 1/8" holes, holes 23/32 centers; CPN # A16160	Ground RF Connector

* Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
E114	----*	CONTACT, ELECTRICAL POWER: phosphor bronze, silver plated; length 2 in.; width 2 in.; height 5/16 in.; maximum useable clearance 1/4 in.; surrounds connector; four 1/8 in. dia mounting holes, spaced 29/32 in. c to c; CPN # A16161	Ground Power Connector
E115	----	SHIELD, ELECTRON TUBE: 7 pin medium miniature, nickel plated, brass shield, cylindrical and bracket mounted 1-3/4 in. long; Elco Corp. Model 120; CPN # X1108	Shield for V102
E116	----	SHIELD, ELECTRON TUBE: 7 pin long miniature, nickel plated, brass shield, cylindrical and bracket mounted, length 2-1/4 in.; Elco Corp. Model 149; CPN # X1110	Shield for V106
E117	----	SHIELD, ELECTRON TUBE: 9 pin medium miniature, nickel plated, brass shield, cylindrical and bracket mounted, length 1-15/16 in.; Elco Corp. Model 191; CPN # X1103	Shield for V101
E118	----	SHIELD, ELECTRON TUBE: 9 pin long miniature, nickel plated, brass shield, cylindrical and bracket mounted, length 2-3/8"; Elco Corp. Model 195; CPN # X2001	Shield for V103
E119	----	SHIELD, ELECTRON TUBE: same as E115	Shield for V104
E120	----	SHIELD, ELECTRON TUBE: same as E115	Shield for V105
E121	----	SHIELD, ELECTRON TUBE: same as E115	Shield for V107
E122	----	SHIELD, ELECTRON TUBE: same as E115	Shield for V108
E123	----	SHIELD, ELECTRON TUBE: same as E116	Shield for V111
E124	----	SHIELD, ELECTRON TUBE: same as E117	Shield for V109
E125	----	SHIELD, ELECTRON TUBE: same as E117	Shield for V113
F101	----	FUSE CARTRIDGE: Electrical rating; 2 amp, 250 V; instantaneous operation; CFA Type AGC2; CPN # F1003	Protect the equipment from excessive current
F102	----	FUSE, CARTRIDGE: same as F101	Protect the equipment from excessive current
F103	----	FUSE, CARTRIDGE: same as F101	Spare for F101 and F102
F104	----	FUSE, CARTRIDGE: same as F101	Spare for F101 and F102

*Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
H101 H102 H103 H104 H105 H106	----*	BOLT, REDUCED SHANK: steel, copper flash with heavy black nickel plate; round head; 9/16 in. dia, 1/4 in. high; reduced shank 1/2 in. lg, .187 in. dia; thread 1/4-20 NCT class 2, 3/8 in. long; bolt 1-3/16 in. overall; head has screwdriver slot; CPN # H1381a	Hold panel to cabinet
H107	----	CLAMP, ELECTRICAL: aluminum; fastening device: 2 clamp screws; screws on to connector by means of 3/4 - 20 internal thread; designed to hold material 1/2 in. max dia; CPH Type AN-3057-6; CPN # J1026	Support power cable wire at the plug
H108	----*	CLAMP, ELECTRICAL: material: brass, linen base bakelite, piano wire; overall dimensions: 2 in. wide, 3/4 in. deep, 4-1/2 in. through eyelets on clamp, mounting centers adjustable; designed to hold material 4-1/4 in. max height; CPN # K26084	Clamp E105 to V112
H109	----	CLAMP, ELECTRICAL: brass; zinc, cadmium or nickel plated; consists of two pieces: Part 1 is hex nut, tapped 3/8:32 which screws on to Part 2 a hex nut tapped 3/8:32 with extended bushing; designed to hold 1/4 in. dia round shaft; CPN # HX 1211-1; CPN # HX 1211-2	Lock Shaft of R119
H110	----	CLAMP, ELECTRICAL: same as H109	Lock Shaft of R127
H111	----	CLAMP, ELECTRICAL: aluminum and rubber; one bolt type fastening device; designed to hold material of 2-7/16 in. max dia; CPN # A1624	Mounting Clamp for CRT Tube Shield
H112	----	ALLEN WRENCH: #8; Allen Mfg. Co Code 564; CPN # E1009	To adjust Set Screws
H113 H114 H115 H116 H117 H118	----	INSULATOR BUSHING: black rubber grommet; mounting dia. 1/4 "; Goodyear Sundries; CPN # G1001	Bushing thru chassis to protect wire
H119 H120 H121	----	INSULATOR BUSHING: black rubber grommet; mounting dia. 3/8" Goodyear Sundries; CPN # G1003	Bushing thru chassis to protect wire
H122	----	INSULATOR BUSHING: black rubber grommet; mounting dia. 3/4"; Goodyear Sundries; CPN # G1006	Bushing thru chassis to protect wire

*Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
I101	----	LAMP, INCANDESCENT: electrical rating; 6-8 volts, .15 amperes; miniature bayonet base, T 3-1/4 clear bulb, daylight light, CWL # 47; CPN # B1007	Power ON-OFF Indicator
J101	----	CONNECTOR, RECEPTACLE: one round female contact; straight type; radio frequency connector, 50 to 72 ohm nominal impedance; 5/8 in. dia cylindrical body; CPH # 83-1R; CPN # J1004	Connect Panoramic Indicator to R.F. input cable
J102	----	CONNECTOR, RECEPTACLE: 3 round male contacts; polarized; contact electrical rating: 150 volts RMS, 20 amperes; aluminum shell; mica filled insert; CPA # AN3102A-14S-7P; CPN # P2001	Connect Panoramic Indicator to power input cable
L101	----	REACTOR: Filter choke; 2 sections; overall inductance 11.7 henries; inductance of each section: 5.85 henries; 380 ohms d.c. resistance (190 ohms per section); hermetically sealed metal case; 3 Heldor No. 250B terminals located on bottom; CTG # 1B212; CPN # P1555d	Filter choke for B+ supply
L102	----	COIL ASSEMBLY, RADIO FREQUENCY: one universal type winding, 137 turns of 20-44 S.S.E. Litz wire; adjustable iron core; coil wax impregnated; CPN # Z26205	Intermediate Freq. Trap
N101	----*	SCALE, OSCILLOSCOPE: 10 horizontal and 4 vertical scale graduations; attached by means of cathode ray tube boot; material green lumarith; CPN # N16089	Indicates relative frequencies and amplitudes of radio frequency input.
O101	----*	BOOT, CATHODE RAY TUBE: Foam rubber, black latex finish; truncated hollow cone; CPN # G1018	Support V110 and hold N101
P101	----	CONNECTOR, PLUG: one round male contact; straight type; radio frequency connector, 50 to 72 ohms nominal impedance, silver plated; mica filled bakelite insert; part of W101; CPH # 83-1SPN; CPN # P1010	Connect R.F. input cable to Panoramic Indicator
P102	----	CONNECTOR, ADAPTOR: one end has 1 round female contact, other end has 1 round male contact; 90 degree angle type; radio frequency connector 50 to 72 ohms nominal impedance, silver plated styramic insert; CPH # 83-58; CPN # P1011	Interconnect R.F. input cable and Panoramic Indicator
P103	----	CONNECTOR, PLUG: 3 round female contacts; polarized, straight; electrical rating; 150 volts RMS, 20 amperes; cylindrical aluminum shell and coupling ring; mica filled bakelite insert; CPH # AN3106A-14S-7S; CPN # J2002	Connect power input cable to Panoramic Indicator

*Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
P201	----	CONNECTOR PLUG: same as P101	Connect R.F. input cable to R.F. source
R101	N16-R-49444-446	RESISTOR, FIXED, COMPOSITION: 51 ohms; ±5%; 1/2 Watt; CBZ Type EB; CPN # RC20BE510J	R.F. termination
R102	N16-R-49688-826	RESISTOR, FIXED, COMPOSITION: 270 ohms; ±10%; 1/2 Watt; CBZ Type EB; CPN # RC20BE271K	Cathode bias of V101; R.F. Amplifier
R103	N16-R-50128-446	RESISTOR, FIXED, COMPOSITION: 4,700 ohms; ±5%; 1/2 Watt; CBZ Type EB; CPN # RC 20BE472J	Grid resistor of V101; R.F. Amplifier
R104	----	RESISTOR, FIXED, COMPOSITION: same as R102	Cathode bias resistor of V101; R.F. Amplifier
R105	----	Omitted	
R106	N16-R-49922-826	RESISTOR, FIXED COMPOSITION: 1,000 ohms; ±10%; 1/2 Watt; CBZ Type EB; CPN # RC20BE102K	Plate decoupling of V101; R.F. Amplifier
R107	N16-R-50651-826	RESISTOR, FIXED, COMPOSITION: 120,000 ohms; ±10%; 1/2 Watt; CBZ Type EB; CPN # RC20BE124K	Voltage divider to Gain control
R108	----	RESISTOR, VARIABLE: composition element; one section, 10,000 ohms, ±20% tolerance; 1/2 Watt; CTC Series 35; CPN # RVA103GQ1J	R.F. Gain control of V101; R.F. Amplifier of V102; Bandpass Amp.
R109	----	RESISTOR, FIXED, COMPOSITION: same as R102	Cathode bias Resistor of V102; Bandpass Amp.
R110	----	Omitted	
R111	N16-R-50587-766	RESISTOR, FIXED, COMPOSITION: 82,000 ohms; ±5%; 1 Watt; CBZ Type GB; CPN # RC30BE823J	Screen dropping of V102; Bandpass Amp.
R112	----	Omitted	
R113	N16-R-50372-826	RESISTOR, FIXED, COMPOSITION: 22,000 ohms; ±10%; 1/2 Watt; CBZ Type EB; CPN # RC20BE223K	Grid leak of V103; Freq. Mixer
R114	N16-R-50652-246	RESISTOR, FIXED, COMPOSITION: 120,000 ohms; ±10%; 1 Watt; CBZ Type GB; CPN # RC30BE124K	Voltage divider to cathode of V108; Reactance Modulator
R115	----	RESISTOR, FIXED, COMPOSITION: same as R106	Voltage divider resistor; grid bias to V104; IF Amp.

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
R116	N16-R-49364-826	RESISTOR, FIXED, COMPOSITION: 33 ohms; ±10%; 1/2 Watt; CBZ Type EB; CPN # RC20BE330K	Cathode bias of V104; IF Amplifier
R117	N16-R-49940-826	RESISTOR, FIXED, COMPOSITION: 1,200 ohms; ±10%; 1/2 Watt; CBZ Type EB; CPN # RC20BE122K	Voltage divider; grid bias to V103, Freq. Mixer
R118	N16-R-50380-766	RESISTOR, FIXED, COMPOSITION: 24,000 ohms; ±5%; 1 Watt; CBZ Type GB; CPN # RC30BE243J	Voltage divider to screen of V104; IF Amplifier
R119	----	RESISTOR, VARIABLE: composition element; one section, 100,000 ohms, ±20% tolerance; 1/2 Watt; CTC Series 35; CPN # RVA104BQ1J	IF Gain Pad; screen of V104; IF Amplifier
R120	N16-R-50146-766	RESISTOR, FIXED, COMPOSITION: 5,100 ohms; ±5%; 1 Watt; CBZ Type GB; CPN # RC30BE512J	Plate decoupling of V104; IF Amplifier
R121	----	Omitted	
R122	----	RESISTOR, FIXED, WIRE WOUND: 4,000 ohms total resistance, ±10% tolerance; 25 Watt; CAO # 25F4000; CPN # RW25X402	Voltage dropping to plate of V106; Voltage Regulator
R123	----	RESISTOR FIXED, COMPOSITION: same as R102	Plate decoupling of V107; Local Osc.
R124	N16-R-50480-826	RESISTOR, FIXED, COMPOSITION: 47,000 ohms; ±10%; 1/2 Watt; CBZ Type EB; CPN # RC20BE473K	Grid leak of V107; Local Osc.
R125	N16-R-50714-826	RESISTOR, FIXED, COMPOSITION: 220,000 ohms; ±10%; 1/2 Watt; CBZ Type EB; CPN # RC20BE224K	Grid of V108; Reactance Modulator
R126	N16-R-50238-566	RESISTOR, FIXED, COMPOSITION: 8,200 ohms; ±10%; 2 Watt; CBZ Type HB; CPN # RC40BE822K	Decoupling to plate of V103
R127	----	RESISTOR, VARIABLE: composition element; one section, 1,000 ohms, ±20% tolerance; 1/2 Watt; stdA taper; CTC Series 35; CPN # RVA102BQ1J	Center Frequency Pad; cathode of V108; Freq. Modulator
R128	N16-R-49786-446	RESISTOR, FIXED, COMPOSITION: 510 ohms; ±5%; 1/2 Watt; CBZ Type EB; CPN # RC20BE511J	Cathode bias of V108; Reactance Modulator
R129	N16-R-49661-826	RESISTOR, FIXED, COMPOSITION: body style no. 14; 220 ohms; ±10%; 1/2 Watt; CBZ Type EB; CPN # RC20BE221K	Cathode bias of V108; Reactance Modulator

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
R130	N16-R-49661-826	RESISTOR, VARIABLE: one section, 500 ohms, ±20% tolerance; 1/2 Watt; stdA taper; CTC Series 35; CPN # RVA501BQLJ	Center Frequency control; cathode of V108; Reactance Modulator
R131	N16-R-50650-446	RESISTOR, FIXED, COMPOSITION: 120,000 ohms; ±5%; 1/2 Watt; CBZ Type EB; CPN # RC20BE124J	Voltage divider; screen of V110; cathode ray tube indicator
R132	----	RESISTOR, VARIABLE: composition element; one section, 500,000 ohms, ±20% tolerance; 1/2 Watt; stdA taper; CTC Series 35; CPN # RVA504BQLJ	Horizontal positioning; cathode circuit of V109; Sweep Amplifier
R133	N16-R-50713-446	RESISTOR, FIXED, COMPOSITION: 150,000 ohms; ±5%; 1 Watt; CBZ Type GB; CPN # RC30BE154J	Voltage divider; cathode of V109; Sweep Amp.
R134	N16-R-50722-466	RESISTOR, FIXED, COMPOSITION: 240,000 ohms; ±5% 1/2 Watt; CBZ Type EB; CPN # RC20BE244J	Plate load of V109; Sweep Amplifier
R135	N16-R-50677-446	RESISTOR, FIXED, COMPOSITION: 150,000 ohms; ±5% 1/2 Watt; CBZ Type EB; CPN # RC20BE154J	Plate load of V109; Video Amplifier
R136	----	RESISTOR, VARIABLE: same as R132	Vertical positioning; cathode circuit of V109; Video Amplifier
R137	----	RESISTOR, FIXED, COMPOSITION: same as R133	Voltage divider; cathode of V109; Video Amp.
R138	N16-R-50974-446	RESISTOR, FIXED, COMPOSITION: 1 megohm; ±5%; 1/2 Watt; CBZ Type EB; CPN # RC20BE105J	Voltage divider, grid of V109; Video Amp.
R139	----	RESISTOR, FIXED, COMPOSITION: same as R135	Plate load of V105; Video Amplifier
R140	----	RESISTOR, FIXED, COMPOSITION: same as R107	Voltage divider; H.V.
R141	N16-R-50722-766	RESISTOR, FIXED, COMPOSITION: 240,000 ohms; ±5%; 1 Watt; CBZ Type GB; CPN # RC30BE244J	Voltage divider; H.V.
R142	----	RESISTOR, FIXED, COMPOSITION: same as R140	Voltage divider; H.V.
R143	N16-R-51019-446	RESISTOR, FIXED, COMPOSITION: 1.5 megohm; ±5%; 1/2 Watt; CBZ Type EB; CPN # RC20BE155J	Voltage divider, grid of V109; Sweep Amp.

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
R144	N16-R-50632-446	RESISTOR, FIXED, COMPOSITION: 100,000 ohms; ±5%; 1/2 Watt; CBZ Type EB; CPN # RC20BE104J	Voltage divider; grid of V109; Sweep Amp.
R145	N16-R-50237-826	RESISTOR, FIXED, COMPOSITION: 6,800 ohms; ±5%; 1/2 Watt; CBZ Type EB; CPN # RC20BE682K	Cathode bias of V109; Sweep Amplifier
R146	----	RESISTOR, FIXED, COMPOSITION: same as R145	Cathode bias of V109; Video Amplifier
R147	N16-R-50569-446	RESISTOR, FIXED, COMPOSITION: 75,000 ohms; ±5%; 1/2 Watt; CBZ Type EB; CPN # RC20BE753J	Voltage divider; grid of V109; Video Amp.
R148	----	RESISTOR, FIXED, COMPOSITION: same as R144	Voltage divider; screen of V110 cathode ray tube indicator
R149	----	RESISTOR, VARIABLE: composition element; one section, 250,000 ohms, ±20% tolerance; 1/2 Watt; stdA taper; CTC Series 35; CPN # RVA254BQ1J	Focus; grid of V110; cathode ray tube indicator
R150	----	RESISTOR, FIXED, COMPOSITION: same as R114	Voltage divider, H.V.
R151	----	RESISTOR, VARIABLE: same as R119	Brilliance grid of V110; cathode ray tube indicator
R152	N16-R-50400-246	RESISTOR, FIXED, COMPOSITION: 27,000 ohms; ±10%; 1 Watt; CBZ Type GB; CPN # RC30BE273K	Filter, H.V.
R153	N16-R-51100-446	RESISTOR, FIXED, COMPOSITION: 3 megohms; ±5%; 1/2 Watt; CBZ Type EB; CPN # RC20BE305J	Charging Resistor, plate circuit of V113; Sawtooth Generator
R154	----	RESISTOR, FIXED, COMPOSITION: same as R128	Sync Voltage divider; grid circuit of V113; Sawtooth Generator
R155	----	RESISTOR, FIXED, COMPOSITION: same as R129	Sync Voltage divider; grid circuit of V113; Sawtooth Sweep Gen.
R156	N16-R-50839-446	RESISTOR, FIXED, COMPOSITION: 510K; ±5%; 1/2 Watt; CBZ Type EB; CPN # RC20BE514J	Grid leak of V113; Sawtooth Sweep Gen.

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
R157	----	RESISTOR, VARIABLE: composition element; one section, 1 megohm; ±20% tolerance; 1/2 Watt; stdA taper; CTC Series 35; CPN # RVA105BQ1J	Sync control; grid circuit of V113; Sawtooth Sweep Gen.
R158	----	RESISTOR, FIXED, COMPOSITION: same as R134	Plate load of V113; Horizontal Amplifier
R159	N16-R-50146-446	RESISTOR, FIXED, COMPOSITION; 5,100 ohms; ±5%; 1/2 Watt; CBZ Type EB; CPN # RC20BE512J	Cathode bias of V113; Horizontal Amplifier
R160	N16-R-50399-826	RESISTOR, FIXED, COMPOSITION: 27,000 ohms; ±10%; 1/2 Watt; CBZ Type EB; CPN # RC20BE512J	Cathode bias of V113; Horizontal Amplifier
R161	----	RESISTOR, VARIABLE: composition element; one section; 2 megohms; ±20% tolerance; 1/2 Watt; stdA taper; CTC Series 35; CPN # RVA205BQ1J	Base line size; grid of V113; Hor. Amp.
R162	----	RESISTOR, VARIABLE: same as R157	Sweep Width Limit, cathode circuit of V113 Horizontal Amplifier
R163	----	RESISTOR, VARIABLE: same as R119	Sweep Width Factor, grid circuit of V108
S101	----	SWITCH, TOGGLE: double pole, single throw; rated: 3 amperes; 250 volts; CHH Type ST22K; CPN # S1028CH	Power On-Off switch
T101	----	TRANSFORMER, RADIO FREQUENCY: one universal type winding; 1.5 millihenries; 250 turns of no. 36 S.S.E. wire; tapped at 50 turns; no adjustable tuning; coil wax impregnated; CPN # Z26109	R.F. step-up transformer
T102	----	TRANSFORMER, POWER, STEP-DOWN AND STEP-UP: hermetically sealed steel case; input data: 115/230 volts A.C., 50 to 70 cycles per second, single phase; 5 output winding: 6.4 volts A.C., 3.0 amperes A.C. between terminals 1-2; 590 volts A.C., 0.065 amperes A.C. between terminals 8-11; 525 volts A.C., 0.0015 amperes A.C. between terminals 5-8; 2.5 volts A.C., 1.75 amperes A.C. between terminals 7-5; 6.4 volts A.C., 0.6 amperes A.C. between terminals 6-12; winding between terminals 8 and 11 center tapped, with center tap connected to terminal 2; 2500 volt secondary insulation; wax impregnated; CTG # 5J40; CPN # A15867	Power Supply Transformer

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
T103	----	TRANSFORMER, PULSE: blocking oscillator type; pulse repetition rate 30 cycles per second; primary res. 800 ohms, secondary res. 2000 ohms; hermetically sealed metal case; wax impregnated; 4 no. 312A Heldor terminals; CTG # 2A189; CPN # T24-18C	Blocking Oscillator Transformer
V101	N16-T-58240-10	ELECTRON TUBE: twin triode; glass envelope; 9 pin type; JAN type 12AT7; CRP # JRP12AT7; CPN # JRP12AT7	R.F. input Amplifier
V102	N16-T-56203-50	ELECTRON TUBE: Pentode; glass envelope; CRC # JRC-6AU6; CPN # JRC6AU6	R.F. Bandpass Amplifier
V103	----	ELECTRON TUBE: pentagrid converter; glass envelope; CRC # 6BA7; CPN # 6BA7	R.F. Mixer
V104	----	ELECTRON TUBE: same as V102	I.F. Amplifier
V105	N16-T-56203-60	ELECTRON TUBE: twin diode - triode; glass envelope; JAN type 6AV6; CHS # JAN-CHS-6AV6; CPN # JANCHS6AV6	Second Detector and First Hor. Amplifier
V106	N16-T-52001-5	ELECTRON TUBE: voltage regulator; glass envelope; CRP # JAN-CRP-OB2; CPN # JANCRPOB2	Voltage Regulator
V107	N16-T-56214-50	ELECTRON TUBE: triode; glass envelope; CRP # JRP6C4W; CPN # JRP6C4W	Oscillator
V108	----	ELECTRON TUBE: same as V102	Reactance Modulator
V109	----	ELECTRON TUBE: same as V101	Second Horizontal and Vertical Amplifier
V110	N16-T-53860	ELECTRON TUBE: cathode ray; glass envelope; funnel shaped, largest dia 3 in.; CRC # JAN-CRC-3RP1; CPN # JANCRC3RP1	Indicator Tube
V111	N16-T-56840-50	ELECTRON TUBE: full wave rectifier; glass envelope; CRP # JAN-CRP-6X4W; CPN # JANCRP6X4W	Low Voltage Rectifier
V112	N16-T-52822	ELECTRON TUBE: half wave rectifier; glass envelope; CNU # JAN-CNU-2X2A; CPN # JANCNU2X2A	High Voltage Rectifier
V113	----	ELECTRON TUBE: same as V101	Blocking Oscillator and Hor. Amplifier
W101	AN Cord CG-107/U (3'0")*	CABLE ASSEMBLY: AN-RG8/U; 52 ohms; black vinyl jacket .405 in. OD; single copper shield; terminated in two Navy Type 49195 plugs at each end; CPN # W16208	Radio Frequency cable with connectors

* Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
XF101	----*	FUSEHOLDER: extractor type; 15 ampere rating; accommodates one extractor type fuse, bakelite body; one fixed clip contact and one spring contact; CFA Type HKM; CPN # F1001	Accommodates F101 electrically and mechanically
XF102	----	FUSEHOLDER: same as XF101	Accommodates F102 electrically and mechanically
XF103	----	FUSEHOLDER: block type; no electrical connection; accommodates one cartridge type fuse; bakelite body; 2 phosphur bronze clip type contacts; CLF # 357-001; CPN # F1012	Hold spare fuse F103
XF104	----	FUSEHOLDER: same as XF103	Hold spare fuse F104
XF105	----	FUSEHOLDER: same as XF103	Hold alignment tool, E101
XI101	----*	LIGHT, INDICATOR: supplied with lens: 7/16 in. dia, green, smooth frosted finish, screw-in lens mounting; enclosed bakelite and brass shell, metal surfaces polished chromium plated; lamp replaceable from front of panel; CAYZ # 81410-622; CPN # B1014BN	Accommodates incandescent lamp I101 electrically and mechanically
XI101A	----	LAMPHOLDER: single holder; part of XI101; CAYZ # 81410; CPN # B1014BN-1	Accommodates I101 electrically and mechanically
XI101B	----	LENS, INDICATOR LIGHT: green, convex, glass, frosted; mounted in chromium plated brass mounting; part of XI101; CAYZ # 81622; CPN # B1014BN-2	Protect and transmit light from I101
XV101	----	SOCKET, ELECTRON TUBE: 9 contacts, beryllium copper, silver plated; miniature size; includes brass nickel plated base shield; ceramic body; mounted from above the chassis by means of one piece saddle; with center shield; Elco Manufacturing Company Type 176BC; CPN # X1100	Accommodate terminals of V101 electrically and mechanically and hold tube shield
XV102	----	SOCKET, ELECTRON TUBE: 7 contacts, beryllium copper, silver plated; miniature size; includes brass nickel plated base shield; with center shield; round shape; ceramic body material; mounted from above the chassis by means of one piece saddle; Elco Manufacturing Company Type 238BC; CPN # X1010	Accommodate terminals of V102 electrically and mechanically and hold tube shield
XV103	----	SOCKET, ELECTRON TUBE: same as XV101	Accommodate terminals of V103 electrically and mechanically and hold tube shield

* Not furnished as a maintenance part. If failure occurs, do not request replacement unless the item cannot be repaired or fabricated.

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
XV104 to XV108	----	SOCKETS, ELECTRON TUBE: same as XV102	Accommodate terminals of V104 to V108, respectively, electrically and mechanically and hold tube shield
XV109	----	SOCKET, ELECTRON TUBE: same as XV101	Accommodate terminals of V109 electrically and mechanically and hold tube shield
XV110	----	SOCKET, ELECTRON TUBE: 12 contacts, silver plated contacts number 5 and 11 missing; round shaped body; black bakelite body; mounted by means of a bracket; CYA # 212-FTS; CPN # X1084A,B,C	Accommodate terminals of V110 electrically and mechanically
XV111	----	SOCKET, ELECTRON TUBE: same as XV102	Accommodate terminals of V111 electrically and mechanically and hold tube shield
XV112	----	SOCKET, ELECTRON TUBE: 4 silver plated phosphor bronze contacts; round socket; steatite body; mounted by means of retainer ring to mounting plate; CPH # 49368; CPN # X1004	Accommodate terminals of V112 electrically and mechanically and hold tube shield
XV113	----	SOCKET, ELECTRON TUBE: same as XV101	Accommodate terminals of V113 electrically and mechanically and hold tube shield
Z101	----	FILTER, LOW PASS, RADIO FREQUENCY: universal type winding; tunable from top and bottom; shielded by rectangular aluminum can, polished finish; shield stamped Z101; coil wax impregnated; CPN # Z26108	Low Pass Filter; plate of V101; R.F. Amplifier
Z102	----	BANDPASS, RADIO FREQUENCY: 2 universal type windings, 350 KC tunable from bottom, 450 KC tunable from top; by adjustable iron cores; shielded by rectangular aluminum can, polished finish; CPN # Z26105	Mixer Input Filter
Z103	----	TRANSFORMER, OSCILLATOR, RADIO FREQUENCY: two, 1 pie universal type windings; dc resistance of primary 10.5 ohms, dc resistance of secondary 60 ohms; primary tuned; secondary not tuned; primary tapped; rectangular aluminum shield; polished finish; adjustabe tuning from bottom by means of adjustable iron core; shield stamped; coil wax impregnated; CPN # Z26080	Oscillator Transformer

Reference Designation	Stock Number Standard Navy	Name and Description	Locating Function
Z104	----	TRANSFORMER, INTERMEDIATE FREQUENCY: 226,000 cycles per second peak frequency; input intermediate frequency transformer; shielded; bakelite coil form; double tuned by means of adjustable iron core; CPN # Z26107	First I.F. Transformer
Z105	----	TRANSFORMER, INTERMEDIATE FREQUENCY: 226,000 cycles per second peak frequency; output intermediate frequency transformer; shielded; bakelite coil form; double tuned by means of adjustable iron core; CPN # Z26106	Second I.F. Transformer

Table 8-2. Maintenance Parts Kit

Key Designation	Name of Part	Quantity
L101	Reactor	1
L102	Coil Assembly, RF	1
T101	Transformer, RF	1
T102	Transformer, Power	1
T103	Transformer, Pulse	1
Z101	Filter, Low Pass, RF	1
Z102	Filter, Bandpass, RF	1
Z103	Transformer, Oscillator, RF	1
Z104	Transformer, IF	1
Z105	Transformer, IF	1

8-3. Manufacturers' Designating Symbols

CAU - Ward Leonard Co., 6 South St., Mount Vernon, N. Y.

CD - Cornell-Dubilier Corp., Hamilton Blvd., South Plainfield, N. J.

CFA - Bussman Mfg. Co., 2538 W. University St., St. Louis 7, Mo.

CGF - Gudeman Co., 361 W. Superior St., Chicago, Ill.

CHH - Arrow-Hart & Hegeman Electric Co., 103 Hawthorne St., Hartford 6, Conn.

CHS - Hygrade Sylvania Corp., 62 Boston St., Salem, Mass.

CLF - Littelfuse Laboratories, Inc. 4757 N. Ravenswood Ave., Chicago 40, Ill.

CMF - Electro-Motive Mfg. Co., 8 Park St., Willimantic, Conn.

CNU - National Union Radio Corp., 1181 McCarter Highway, Newark 2, N. J.

CPA - Palmer Co., 2500 Norwood Ave., Cincinnatti, Ohio

CPH - American Phenolic Corp., 1830 S. 54th Ave., Chicago 50, Ill.

CPN - Panoramic Radio Products, Inc., 10 South Second Ave., Mt. Vernon, N. Y.

CRC - RCA Mfg. Co., (Radiotron Div.), Harrison, N. J.

CRP - Raytheon Mfg. & Prod. Co., 55 Chapel St., Newton 58, Mass.

CTC - Chicago Telephone Supply Co., W. Beardsley Ave., Elkhart, Ind.

CTG - General Transformer Corp., Homewood, Illinois

CWL - Westinghouse Lamp Co., Bloomfield, N. J.

CYA - Alden Products Co., 117 N. Main St., Brockton 64, Mass.

CAUP - Kurz-Kasch, Inc., 1421 S. Broadway, Dayton 1, Ohio

CAXP - Lord Mfg., 1635 W. 12th St., Erie 6, Pa.

CAYZ - Dial Light Corp., 900 Broadway, New York 3, N. Y.